TELEPHONE ENGINEER

Vol. V CHICAGO, JUNE, 1911 No. 6

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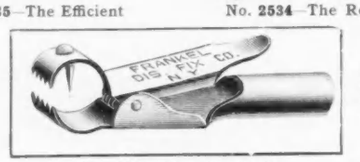

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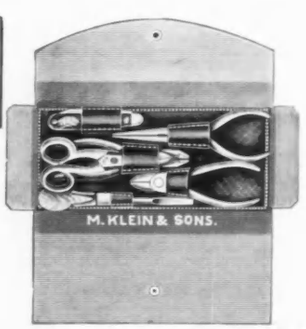

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ESTABLISHED 1902

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CHICAGO, JUNE, 1911.

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THE BELL VIEW OF PHYSICAL CONNECTION.

SEVEN pages of the American Telephone and Telegraph Company's annual report are devoted to an analysis of physical connection and a rather severe arraignment of its principles. After explaining that physical connection means a system of trunks connecting competing exchanges just as the exchanges of a single system are connected, the following is advanced:

> But what has been accomplished? You have enabled any subscriber to any exchange to communicate with any subscriber to any other exchange. You have not avoided the objectionable duplication. You have not given service to all the exchanges for one subscription. This can only be done through merger or combination, not by physical connection. Physical connection implies separate and independent entities. For the privilege of this physical connection with the other exchanges the subscriber to any one of the exchanges must pay. This payment or toll must be more or less the equivalent of what the regular subscribers pay, otherwise there would be discrimination.

According to this, the word "duplication" cannot have the same significance to the Bell people that it has to us. They say "You have not avoided the objectionable duplication." As we understand it, telephonic duplication means that certain subscribers must have one or more stations on the system of each competing company. Surely physical connection would obviate this necessity—that, indeed, is its main object. Evidently the Bell argument refers entirely to outside plant, as instanced in the following:

> One of the arguments for physical connection is that it will stop duplication. How? All agreements as to territory, rates or character of opposition; all arrangements which would come under the head of combination or pooling; all understandings or anything that would be equivalent to consolidation or combination, must be eliminated; this is not what is meant by and is not a part of, physical connection. Leaving all understandings out of consideration, what effect would physical connection have on the local opposition exchanges? Neither exchange could stop competing for subscribers. The exchange that did would soon dwindle to a point of absolute undesirability; in other words, to a point where the subscription list would offer no inducements to others to join. Consequently activity must be maintained, each exchange making every effort not only to retain all on its list of subscribers but to add more. The same territory must be covered, the consequent duplication of conduits, pole lines, central and branch offices must continue; in fact the strife or competition would have to be more severe.

Granted, of course, that under physical connection competitive strife for new subscribers must go on and, perhaps, be even more severe, since the smaller company can offer its prospects as many (and the same) possible connections as the larger. We cannot deny, too, that under the stress of competition there is bound to be duplication of conduits and pole lines—we are not so sure about the central and branch offices. But while this duplication of construction really constitutes the only logically uneconomical feature of physical

connection, even it is not so serious as may at first appear. In a district of one hundred actual subscribers, for example, the economical waste is not the difference between one distributing system and two similar distributing systems, but rather between one distributing system serving one hundred subscribers and two distributing systems serving fifty subscribers each.

The only discrepancy here is that each of the competing systems must provide for an ultimate capacity which it is likely never to reach. But even that condition must be subject to a definite law. Out of a given group of one hundred prospects there must always be a maximum number which either company can secure. Neither company, that is, would be justified in providing for one hundred per cent. That could only be based on an expectation that the competing company would get no subscribers, which would be an unreasonable supposition.

And the same argument applies to central and branch exchanges. A community served by two competing companies with interconnecting arrangements is equivalent to two communities of half the size, providing the service, rates and selling efforts of the two companies are equal. Fluctuations in the latter factors create an unstable or elastic condition in the two hypothetical communities, so that either one may become temporarily or permanently larger or smaller than the other. This elasticity is limited, however, by definite laws. It is stated that "the exchange that did not compete for subscribers would soon dwindle to a point . . . where the subscription list would offer no inducements to others to join." To a certain extent physical connection is an automatic check against even this condition, since the smaller company would be able to offer connections with the subscription list of the greater company. Naturally this would not be entirely to the liking of the larger company, which would covet all possible subscribers for its own system; but that is scarcely an argument against the arrangement. This brings us to the following:

> Physical connection between independent or opposition exchanges means, therefore, the placing of the wires necessary to give it effect out of the control for the time being of the owning company, and under the control of a competing, opposition company, to enable that competing, opposition company to give its subscribers the use of property, equipment, facilities, operating staff, other than its own, and for the time being depriving the owning company and its subscribers of the use of such facilities.
>
> Physical connection demands the exclusive use of an integral part of the property and facilities and operating staff of one company for the customers of a competing company, no matter how urgent may be the owner's necessity for the immediate use of such property and facilities, nor how small the surplus facilities beyond the owner's requirements.

We must confess our inability to grasp this thought. An equitable switching charge certainly contemplates the use specified; and an operating telephone company is in business for the purpose of renting its equipment to whosoever will pay the rental. Nor need there be any fear of a possibility of unequitable switching rates. In a community so divided every subscriber is on a smaller system, and pays a proportionately lower regular rate than would be the case with one system. The subscriber can consequently afford to pay such a switching charge for connection to the other system as will bring the annual cost of his service approximately to equal the cost of service on a single system.

> Physical connection would force the comprehensive Bell System, which has been built up with foresight and enterprise and is being maintained in its completeness at the cost of maintaining unremunerative exchanges and unremunerative lines, to turn over to, and put under control of, any opposition system for its use and benefit, for the time being, a physical part of the property of the Bell System and at the same time deprive the subscribers to the Bell System of the use of such property. Physical connection would oblige any system to construct and maintain surplus facilities and employ a surplus staff of operators for the benefit of any so-called competing or opposition—but less enterprising—company.
>
> No possible compensation would be adequate for such service or such deprivation.

This protest we cannot bring ourselves to regard as seriously as does the Bell system. Indeed, the final asseveration we must consider pure hyperbole. The Bell lines every day are placed at the disposal of those who are not Bell subscribers, through the medium of public pay stations. Why not think of incoming trunks from competing exchanges as pay station lines, and treat them accordingly? Refusal to sell to a competitor what one would sell to a stranger is not fair competition.

> If the equipment and the operating methods of the opposition or independent exchanges physically connected are different, the service is bound to be unsatisfactory. No one of the exchanges can have any control over the operators of the other exchanges. There is bound to be strife and contention between the operators, resulting in delays and poor service. Each exchange must necessarily give preference and attention to its own service.

It sounds rather silly to repeat the old phase "Business is business," but that seems to be the only answer for this argument. We believe the Bell system was the first to call attention to the automaton-like efficiency of its operators—machines except in emergency, and then human intelligences, or words to that effect. Physical connection is not an emergency. It is a perfectly normal arrangement, and its failure could only be laid at the door of deliberate intent.

It is not claimed by anyone that physical connection is better than a single system, nor is it recommended as the ideal basis on which to telephone a new community. But we do claim it is the only reasonable solution of the condition of dual service now existing in some communities. Most of the Bell arguments against physical connection as uneconomical would hold good against consolidation or merger of competing systems. What real duplication of plant it was necessary to eliminate would have to be paid for by some one.

The Bell system has expressed its faith in the principle of commission regulations. Let it, then, leave the matter of physical connection to the commissions. If competing lines make unfair demands on the Bell facilities, the commissions should be as competent to relieve that situation as any other.

RAILWAY TELEPHONY TEN YEARS AGO.

EXACTLY ten years ago a paper entitled "The Telephone in Railway Service" was read before the Association of Railway Telegraph Superintendents by F. P. Valentine. This subject, of course, had nothing to do with train dispatching; it was just a description of the several uses to which the telephone had been put by the railroads up to that time, with an account of the consequent benefits in specific cases and a few predictions and opinions by the author.

As reviving our consciousness of the extreme youth of telephony, Mr. Valentine's comment on the use of the

telephone between the public and the railroad offices is almost amusing. He said: "The public has grown to expect that information shall be furnished by telephone rather than by letter or telegram." A naive statement, indeed, in the light of present practice. Also—"While many question the advisability of giving rates over the telephone, the cases of dispute in regard to the rate quoted form a small percentage of the whole, and, in important cases, the rates quoted may easily be confirmed in writing."

Several times in the course of his paper Mr. Valentine made recommendations based on his observation of conditions, and most of his ideas have since been put into general effect. He called attention to the fact, for example, that the telegraph lines of a railroad were often burdened with much short distance business that could be transacted far more quickly by telephone. Yard offices within half a mile of the main office were handling telegraph messages on through wires, delaying other business, when a few dollars expended on telephone circuits would have relieved the situation and given better satisfaction.

He said, too, that in installing telephone systems at that time a great mistake was often made by railroad companies in endeavoring to economize in the number of instruments; that enough should be provided to care for every branch of the service under any conditions that might arise, especially in relation to offices handling train service. It may not be amiss to say that even at the present day there are several companies which might well take that advice to heart. As a horrible example, he cited an occasion where a telephone company took pains to have the lines of two competing railroads monotoned; and the road whose telephone was constantly reported busy was found to have lost enough business to its competitor *in one day* to pay the rental of a complete branch exchange for a year. This, too, points a sermon for modern telephone users, too many of whom, railroad and otherwise, are "penny wise and pound foolish" in providing themselves with telephone service. "The branch exchange," said Mr. Valentine, "should not only afford connection with points in the immediate vicinity of the terminal, but it will be found advantageous to extend the lines to the outlying towers and stations, supplementing the telegraph service and in many cases economizing in the number of telegraph operations it is necessto employ, as there are many stations and towers where it is necessary to use train orders, and the use of the telephone relieves the telegraph wires of miscellaneous business."

His description of contemporary railway telephone installations were extremely interesting. Some of them revealed an early development in this field that would amaze those who regard railway telephony as a particular feature of the last two or three years. Indeed, the contrast between the thoroughly equipped telephone systems of some of the roads, and the attitude of contempt or suspicion toward the telephone taken by others of the same period, is quite striking. And so short is ten years in the development of an industry that even today, when the railway commercial and intercommunicating telephone are regarded as daily necessities, a few railroad men still regard with strong doubt the efficiency of that instrument for the responsible work for handling train orders. These few skeptics, however, seem in danger of being overwhelmed with uncontrovertible evidence that the telephone is far superior to any other means of communication, whatever the particular application.

In 1901 the telephone was not used for train dispatching. That its application to that purpose was even then occupying the minds of railroad men is indicated, however, by the following extract from Mr. Valentine's talk:

"When railroads have equipped themselves so that they can care for their commercial and domestic office business, the question of train operation by telephone instead of by telegraph will be settled on its merits, but this should not be attempted until the equipment is sufficient and suitable, and the service is brought up to a standard that will compare favorably with that furnished by the more progressive of the telephone companies. Much of the criticism as to the danger of transmitting train orders by telephone has been justly based on the poorly constructed lines and cheap equipment used by many of the railroads, under the belief that economy in initial cost is the principal thing to be considered. In itself the substitution of telephone for telegraph is no more radical a change than took place when reading by sound supplanted the use of the register on the telegraph wires."

Evidently, however, the speaker was ahead of his time. In the *Railroad Gazette* for July 5, 1901, appeared the following editorial, and attention is called to the last paragraph:

The paper by Mr. Valentine on telephones in railroad service which was read before the railroad telegraph superintendents at their annual convention is a valuable chronicle of experiences, in some respects unique. Mr. Valentine's road, the New York, New Haven & Hartford, is, we believe, the only one in the country which has a superintendent of telephones, a circumstance which indicates the importance of that field of work in the company's operations; and the facts given in the paper are told with care. This gives to the author's recommendations a weight that those of a mere experimenter would not have, particularly as the New Haven is a very conservative company. The magnitude of the telephone business can hardly be appreciated except after considerable study, it has grown up so quietly. Sixteen hundred calls on one ticket office in a single day; a saving of the wages of two switching crews in a yard by stopping unnecessary switching and delays; complete abolishing of the telegraph at an important terminal signal tower; these and other similar changes and economies are scarcely believable until one examines the situation in detail on the ground. As the New Haven and the Pennsylvania are the only roads which have developed their telephone service in just the ways mentioned by Mr. Valentine, the reader will have little difficulty in localizing the various features of telephone service that are described.

Probably the only assertion which Mr. Valentine's hearers were inclined to classify as debatable was that about the use of the telephone for the transmission of train orders. He says that the supercedure of the telegraph by the telephone is no more radical than was the change from Morse registers to sounders. We are not sure that he is right about this; but whether the telephone is as good as its enthusiastic supporters claim, or is only partly satisfactory, we have no fear that it is going to hurt the telegraph fraternity. Improvements follow one another nowadays with bewildering rapidity, but there is no doubt the dispatchers and the telegraph operators will keep abreast of the times, and without sacrifice either of money or happiness.

The editorial writer has found that he was overskeptical as to the telephonic transmission of train orders, and that Mr. Valentine's enthusiasm was, after all, but plain foresight. It is our turn to predict that in another ten years the Morse telegraph will be unknown. It has served its day, and served it well, and it can retire with honors. But modern requirements call for modern methods, and the telephone alone can transmit human intelligence as it is needed in the transaction of business of any sort, unchanged and without apology.

THE HOUSE ORGAN.

HOUSE organs are advertising circulars or bulletins made up in imitation of bonafide trade journals and issued periodically. Mose of them are distributed free, at least in large part; although they frequently contain enough original information to make them worth a subscription price. Indeed, in some respects they have the advantage of genuine trade papers in the matter of news-gathering and preparing technical articles. They generally have at the disposal of their editors the whole technical staff of the manufacturers who publish them, as well as the services of the field representatives of those manufacturers, who, if not actually directed to furnish material for the weekly or monthly organ, do so nevertheless from various motives.

Therefore we have no argument with the house organ on the basis of quality. When such a publication is issued by a large and powerful house, or even a group of such houses, any lack of interesting material must be wholly due to inefficient editing rather than to an inherent defect in the scheme. But we do say that the actual effect of the house organ is always more or less vicious. Listen to what Hugh M. Wilson, vice president of the McGraw Publishing Company, said about such publications in an address before the Technical Publicity Association, New York:

> It needs no argument to prove that the chief requisites of a good medium in the industrial field are: 1. A journal with resources enough to provide an adequate staff, and with courage enough to have opinions of its own and to publish essential facts pertaining to the ideas and events of the day.
>
> 2. A paid circulation large enough to thoroughly cover its field, and
>
> 3. A policy regarding advertising that will make its advertising pages look like a well-tilled field and not like a graveyard.
>
> Now, you ask what all this has to do with house organs. It has this to do with them: The house organ journalistically considered is essentially reactionary. It assumes the airs and the habiliments of a periodical. It is a special exclusive advertisement in the guise of a trade journal.
>
> The more it looks like, and the larger the number of people who believe it to be the "real thing," the more the "house" likes the melody of its organ. The more widespread the belief among those who receive it that it is an impartial exponent of truth, pure and undefiled, the more completely it serves the purpose for which it is published.
>
> When the reader awakes, when he realizes that he has been reading a special plea, his distrust is aroused. He generalizes from the special instance, and what is the result? The result is that he puts the house organs and the technical papers all in the same category and doubts the good faith of the whole lot. The house organ, therefore, tends to rob the technical journal of its most valuable asset, its most precious attribute—the trust and confidence of its readers in its purity of purpose. And what has the house organ gained for itself? Absolutely nothing that it could not have got in other ways at less cost.
>
> But the damage does not stop there. Take the question of circulation. The advertisers of this country in recent years very properly have been insisting that trade and technical journals should show up and tell their actual paid circulation. A great deal of good has been done by this demand. The business has been purged of its sample copy secretions. It has given the honest publisher the advantage to which he is entitled. People are more likely to buy a well-edited than a poorly edited journal. But they are not likely to buy a thing that they think they should get for nothing. The house organ comes to them without money and without price. The house organ again wears the mien and simulates the voice of the trade journal. The reader reasons, "If this comes to me for nothing, why should I pay for that?" The house organ again has muddied the waters. And again, the prize obtained by its piracy is not worth what it might cost.
>
> Some of the house organs are able and attractive productions. They must cost a great deal of money. Some of them publish engineering articles of almost incomparable merit. They are able to command the pens of the highly cultivated engineers employed by their own houses. They acquire on demand manuscripts which would but for the first call of the house organ find their way to the editorial offices of the technical papers where they would be welcomed at good prices. I believe that it is fair to say that these articles if published in the best technical papers would reach a much larger audience, would do more good to the profession and industry, and in so far as they contain or imply commercial publicity, they would do the "house" far more good than when confined to the more limited and less attentive audience of the house organ.
>
> The advocates of the house organ may say: "Granting the truth of all you claim, we still contend that we get better results from our organs than you can give us in your papers. If you are hurt that is your funeral. We are not our brothers' keepers." My reply to that is that it has yet to be proven that the same care and attention, the same intelligent and enthusiastic effort to make good copy, the same expenditure of money in addition to that already so generously spent by many of these concerns in the technical papers would not produce better returns than are now obtained from house organs.
>
> But let us leave that and look at the larger question. You are your brothers' keepers. You cannot divorce yourselves from your environment. And the technical press is a vital part of your environment. A weak, inefficient, servile press is a curse to a nation. A contemptible, impotent, unsympathetic technical press would be a blight upon the industry in which it has its being. The business interests of this country might, conceivably, by concerted action, take measures to milk and dwarf its technical press, but the calamity would fall most heavily upon those business interests. If the trade and technical papers have not hitherto in all cases produced satisfactory returns, the remedy is not to be found in advertisers going into the publishing business. The better way would be to improve the publications already established. The editors and publishers of these journals are not heedless to suggestion, nor are they lacking in that professional spirit which is ever eager to embrace ideas looking to improvement and progress.
>
> Those advertisers who publish house organs seem to me to occupy a most inconsistent and untenable position.
>
> They demand (and rightly demand) that we shall publish matter of the first order, and they do what they can to close to us the source of supply for much of that matter.
>
> They insist upon their engineers and experts giving them first call on technical articles pertaining to their operations, and they are hurt in their feelings when we refuse to reprint as original matter those articles at second hand.
>
> They call for courage and impartiality in us, and the breath of their nostrils is prejudice and special pleading.
>
> They complain that there are too many trade and technical journals, and they do what they can to make this confusion worse confounded.
>
> They endeavor to gain special prominence by differentiating themselves from the common herd with their own periodicals, and these organs have become so numerous that they are likely to drown in their own flood.
>
> They insist (and rightly) on paid circulation for us, and they are riotously generous with a free circulation of their own.

GOVERNMENT LINE IN ARGENTINA.

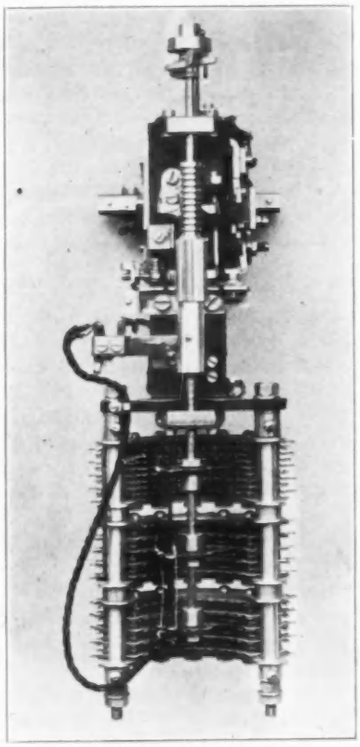
Robert Woods Bliss, American chargé d'affaires at Buenos Aires, reports under recent date that the Congress of the Argentine Republic passed a law in November, 1910, authorizing the appointment of a commission to investigate and report at the next session of congress as to the advisability of establishing, under federal direction, a telephone system throughout the republic. The commission has not yet been named but is now under consideration.

Automatic System at Altenburg, Germany

By Frank C. Perkins

ALTENBURG, a residence city in Saxonia, has a new automatic exchange equipped for a capacity of 1,000 lines, about 700 subscribers being connected up. It is the second city in the German empire equipped with exclusive automatic telephone service, the first automatic telephone exchange being installed in Germany about two years ago at Hildesheim in the Province of Hanover, with about 1,200 lines in service.

It is of interest to note that there is a long distance exchange working in connection with the automatic system, having 24 toll lines. The Altenburg automatic exchange equipment consisting of 1,000 preselectors, two sets of 100 group selectors each and 100 line selectors installed in a selector room measuring 9 meters in length and 6 meters in width.



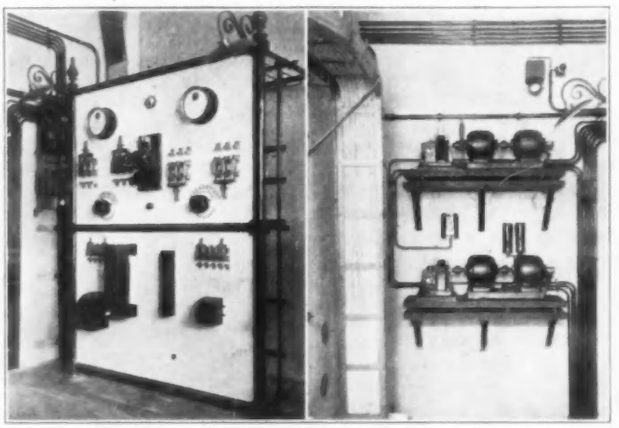
Form of Strowger Switch Used.

The powerboard and motor generator sets for charging and ringing service are installed in an adjoining room measuring 6 meters square, together with the storage battery equipment.

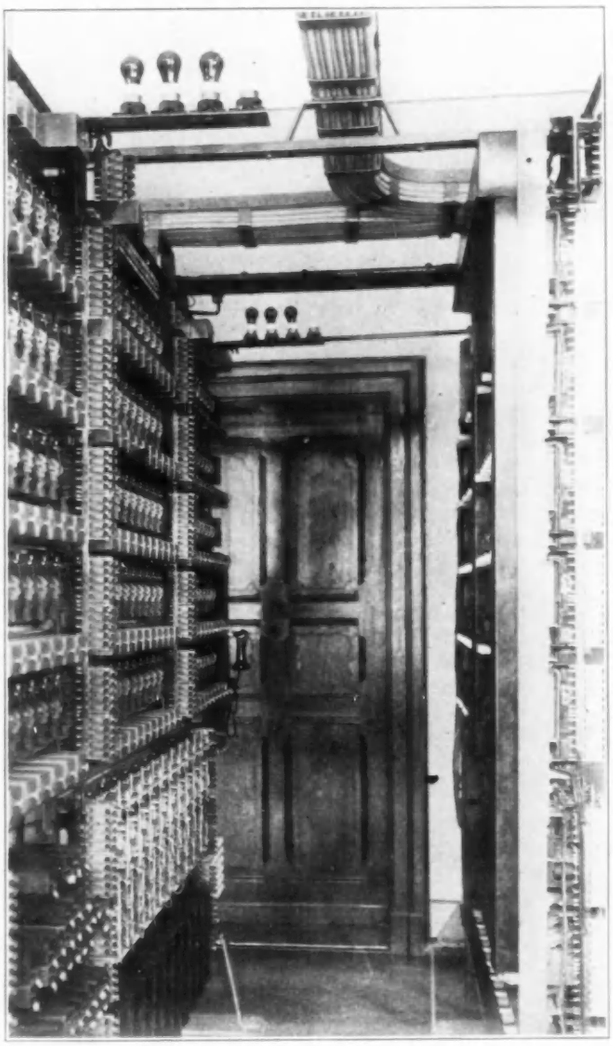
This exchange was completed in four weeks by six men, the change being made from manual to automatic operation in three hours. The long distance equipment includes ten trunk lines, the exchange being provided with manual switchboard with positions for six operators handling 24 long distance lines.

The current is supplied by two sets of storage battery, each having a capacity of 470 ampere hours. This accumulator plant is charged through a regulating resistance from the city direct current electric lighting circuit. The calling current is supplied by motor generator sets of ¼ horse power capacity operated from the same electric lighting mains or from the battery circuit. The entire electrical equipment of this telephone station was constructed at Berlin-Nonnendamm at the Wernerwerk of the Siemens and Halske Aktiengesellschaft.

Automatic telephones are gaining quite a foothold on the European continent, Germany especially seeming to view them in a favorable light. The prevalence of government ownership in Europe naturally militates against any undue efforts to try new method-



Altenburg Power Board. Ringing Machines and Cable Run.



The Switchroom at Altenburg, Germany.

or even, in some cases, to improve old ones. But Germany is a progressive country, and especially fond of ingenious devices designed to do mechanically and automatically what must otherwise be done manually. So it is likely that the automatic telephone has a big field there.

New McAlpin Hotel to Have 1,800 Telephones

What the telephone officials say is the largest telephone contract ever taken has just been signed by Frank M. Andrews, president of the new McAlpin hotel, which will be located on Broadway and 34th street, New York City. The McAlpin hotel will be the best telephone building in the world, having more telephones than many of the towns surrounding New York—as many, it is said, as the town of Peekskill, New York. The contract covers 100 trunk lines, 1,800 stations and 500,000 local messages at an annual value of $28,334 for services.

A supplemental contract provides for a charge of $2,250 covering the installation of 16 telautograph instruments which will be located at various points of the hotel, in addition to the 16 regular operating positions of the switchboard. In addition to the main switchboard there will be three sub-switchboards. One two-position switchboard to be used for pay station purposes in connection with seventeen booths to be located in the main corridor of the hotel; one in the engineering department to serve about sixteen stations and another in the general offices of the hotel, to take care of about twelve extension stations for the use of the hotel management.

The new hotel, it is expected, will open about September 1, 1912.

The Coming A. I. E. E. Chicago Convention

Unusual interest is taken in the forthcoming annual convention of the American Institute of Electrical Engineers, for it will be held in Chicago on June 26 to 30, inclusive, and it has been many years since the convention met in that city, although the electrical attractions of Chicago and vicinity are exceptional in interest and variety. Among these points of interest may be mentioned the Ryerson Physical Laboratory of the University of Chicago, where the atomic theory of electricity has been demonstrated by most interesting experiments; the electric furnaces in the steel mills at South Chicago; the enormous electric plant at the Gary, Ind., steel works, driven by gas engines; the great central stations of Chicago, famous for their size and modern design; the hydroelectric development of Chicago Drainage Canal; "Underground Chicago," with its network of electrically operated freight tunnels; the latest large automatic telephone system; several of the largest manually operated telephone exchanges in the world; street railway and other substations of unusual interest; possibly the largest street railway shops in the world ,with electric drive throughout, and many other notable electrical applications.

The convention will meet in the new Hotel Sherman, the most recently completed of Chicago's group of modern hotels. The sessions will be held in the handsome Louis XVI. room, which will seat 700 people and can be connected with adjoining apartments to seat 1,500 if desired.

While the list of papers to be presented at the convention is not complete, the following partial list of papers that will probably be presented shows the diversity of subjects to be considered: "Economical Design of Direct Current Magnets," by R. Wikander; "Catenary Span Calculations," by W. L. R. Robertson; "Currents in Inductors of Induction Motors," by H. Weichsel; "Multiplex Telephony and Telegraphy by Means of Electric Waves Guided by Wires," by Major G. O. Squier; "Electrolysis in Reinforced Concrete," by C. E. Magnusson; "Induction Motor Design," by T. Hoock; "The High Efficiency Suspension Insulators," by A. O. Austin; "The Electric Strength of Air," by J. B. Whitehead; "Electrification Analysed, and Its Application to Trunk Line Roads," by W. S. Murray; "Telegraph Transmission," by F. F. Fowle; "The Cost of Transformer Losses," by R. W. Atkinson and C. E. Stone; "The Costs of Railway Electrification," by B. F. Wood; "Induction Motor for Single-Phase Traction," by E. F. W. Alexanderson; "Magnetic Properties of Iron at 200,000 Cycles," by E. F. W. Alexanderson; "Electric Storage Batteries," by Bruce Ford; "The Characteristics of Isolated Plants," by P. R. Moses; "Elevator Control," by T. E. Barnum.

A committee of fourteen local members of the Institute has been appointed to make the arrangements for the convention. Mr. Louis A. Ferguson, 120 West Adams street, Chicago, is the chairman of this committee. The program will include visits to points of interest and various social events, and it is confidently expected that the 1911 convention of the Institute will be the most successful in its history.

Telephone Numbers According to Ellis Parker Butler

Speaking of telephone numbers, a good number for a cigar dealer would be 2-4-5, and a cheap suburban sport might as well be 4 Flushing as anything else. An Irishman wishing to dine would naturally call up a place 2-8, but a Hinglishman 'aving to call up a blarsted, bloomin' creditor regarding a bill would be '8-2.

A lover ordering a chair would want 1-4-2, and a newly wed couple wishing a flat would want 1-4-2-2, but the German maiden refusing to marry would shout 9-9-9-9. (Oh, how clever!)

If you want to borrow you wish 4-2-0, and probably that is a money lender's number, but if you only want a small loan from a friend you will wish 2-0-5. (That's pretty cute. What?)

The bookmaker should have two phones—9-2-1 for long shots and 4-2-5 for favorites. The man with a dog might call 6-6-6-6(get that?)—and the farmer should put 8-0 on his list. (Put-eight-o, hey, what! I rather guess that's a rotten potato!)

If two horses were in the running and 1-1-5-0 John he would be a happy lad and his smile would be 2-2 Broad. (This is one I 8-2 Spring on you.) And if John spent the cash for liquor I would cry 5-5-5-4 John! But that is just how careless John is. His drinking is hades for his wife, but it's 7-4 John. (What, ho!)

(Honestly, I could keep this up all night!) If two of you wished to be wed you would not have 2-8-4 Spring, because you could call 4-1 Rector to make you one immediately, and then, if tired of being united in one, you could go to a fat judge and let that 1-2 Broad-party-W again. (If you can't see that, ask for information.)—*Judge.*

Transmission Efficiency and L. D. Circuits

By B. Gherardi*

IN June, 1900, Professor Pupin took out his patents for loading. Since that time practical applications of loading on a very extensive scale have been made in the plants of the American Telephone and Telegraph Company and the Associate Companies, and most gratifying results in improved transmission and economy in first cost of construction have resulted from the applications of Professor Pupin's invention. At first the work done dealt with the loading of ordinary open wire lines and standard cables and with the perfection of the apparatus required to accomplish these results. Later, attention was directed to the more complex problem of loading phantom circuits, the loading of our high-grade No. 8 circuits and the design of special cables so constructed that phantom circuit working was possible in connection with loaded cable conductors. As a result of the work which has been done along these lines during the last two years some very remarkable improvements in the transmission efficiency of long lines and cables have been made. The New York-Denver circuit which is now in operation and the Boston-Washington cable which is in process of manufacture have been made economic possibilities by these advances. While it cannot be said that these results could not have been obtained with our knwoledge of the art as it was two years ago, it may safely be stated without fear of contradiction that the cost of such work, as it would have had to be done with our knowledge of two years ago, would have been so great as to have been commercially prohibitive. Some one once defined an engineer as "a man who could do with one dollar what anyone could do with two." This definition, while not complete, is certainly good as far as it goes and is, I think, well illustrated by the developments which I am going to tell you about this evening.

Diagram 1.

*From a paper read before the New York Telephone Society. Mr. Gherardi is engineer of plant, A. T. & T. Co.

THE NEW YORK-DENVER CIRCUIT.

The New York-Denver circuit has a length of a little over 2,000 miles, that is, it is more than twice as long as the New York-Chicago circuits, which are about 950 miles long, and is a little less than twice as long as the New York-St. Louis circuits, which are about 1,050 miles long. Until the completion of the developments which have made the New York-Denver circuit possible, the New York-Chicago and New York-St. Louis circuits represented practically the limits of long distance transmission. Now service from New York to Denver can be given which is as good as, or even better than, the service given a year or two ago from New York to St. Louis or Chicago, and this without using any heavier wire than was formerly employed. All our old circuits from New York to Chicago and St. Louis were No. 8 B. W. G. wire, weighing 435 pounds to the mile. No heavier wire is used to get the New York-Denver service.

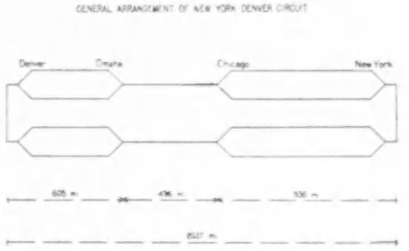


Diagram 2.

One of the aims of Mr. Vail is to give universal service. The first step in the direction of giving such service is obviously to be able to give transcontinental service—that is, a talk from New York to San Francisco. Diagram 1 will show how much of a step in this direction has been made since Mr. Vail's wish on this matter was stated about two years ago. This diagram shows what we could do two years ago, what we can do now, and how much remains to be done to get to San Francisco. It was a long step from Chicago to Denver. One more step a little longer will take us to San Francisco.

Two years ago we did not know how to successfully load No. 8 circuits; how to commercially phantom No. 8 circuits, or how to combine phantoming and loading. Since that time we have found out how to do all of these things, and it is as a result of these

developments that the Denver circuit is a reality today.

Before explaining how each one of these results was accomplished, and the part which each result contributed to the achievement of talking from New York to Denver, I will describe the circuit. Diagram 2 shows in a general way the New York-Denver circuit. From New York to Morrell Park (the test station just outside of Chicago), there are two loaded No. 8 circuits. These are phantomed, thus creating a third circuit and this phantom is also loaded. From Morrell Park to Omaha there is a loaded No. 8 circuit. No loaded phantom has as yet been provided here because the pole line did not carry two No. 8 circuits so located with relation to each other that they could be phantomed. Arrangements are being made to move a No. 8 circuit on this line to pins adjacent to the present loaded No. 8 circuit and as soon as this is done a phantom will be created from the two circuits and this phantom will also be loaded, thus giving between Chicago and Omaha the same arrangement as now already exists between New York and Chicago. From Omaha to Denver there are two No. 8 circuits which have been phantomed, thus creating a third circuit, and the two physical circuits and the phantomed circuit are all loaded, thus giving from Omaha to Denver the same general circuit equipment as now exists between New York and Morrell Park.

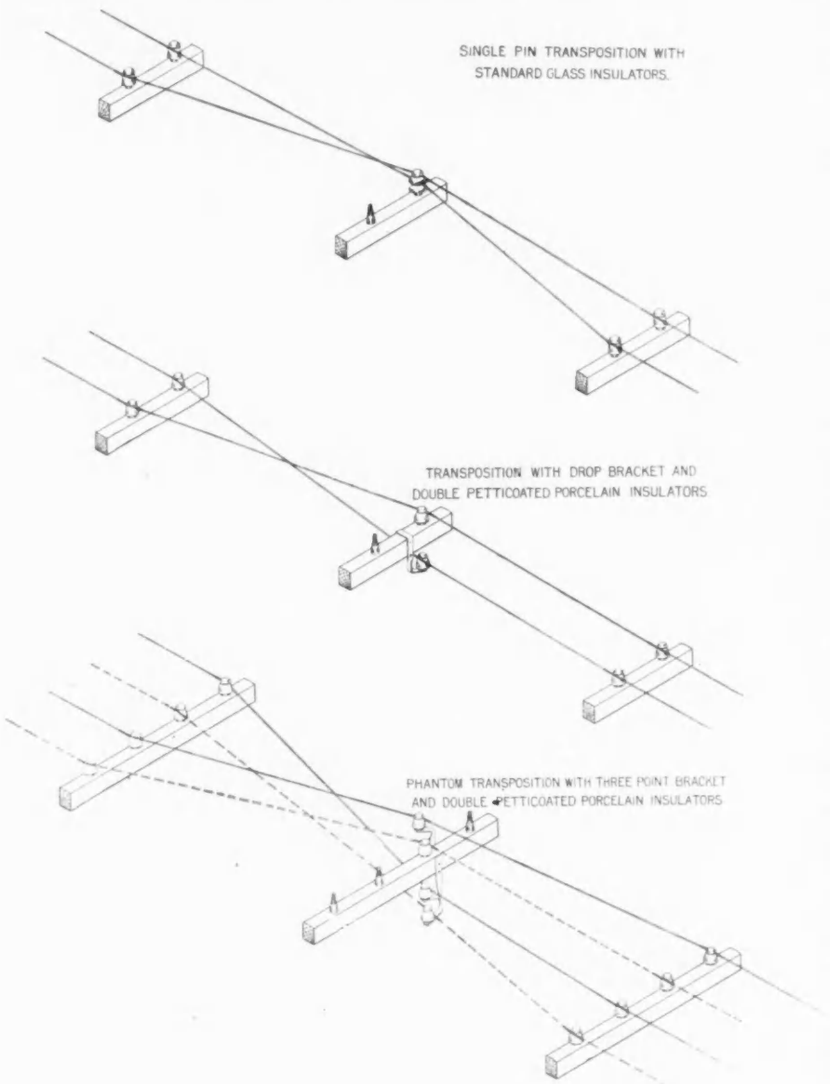

SINGLE PIN TRANSPOSITION WITH STANDARD GLASS INSULATORS.
TRANSPOSITION WITH DROP BRACKET AND DOUBLE PETTICOATED PORCELAIN INSULATORS
PHANTOM TRANSPOSITION WITH THREE POINT BRACKET AND DOUBLE PETTICOATED PORCELAIN INSULATORS

Diagram 8.

The circuit from New York to Denver, utilizing the phantoms where they exist and including the reflection losses due to the present irregular arrangement, is equivalent in transmission efficiency to about 30 miles of standard cable. The circuit if connected throughout on a non-phantomed physical circuit over the same route is equivalent to about 32 miles of standard cable. When the final arrangement is completed between Chicago and Omaha our present estimate is that a New York-Denver connection on the phantom will be equivalent to between 28 and 29 miles of standard cable. If the circuit were made up throughout of unloaded No. 8's it would be equivalent to 69 miles of standard cable. A No. 8 unloaded circuit from New York to Chicago by the shortest route is equivalent to about 34 miles of standard cable from test board to test board. It will thus be seen that the new circuits to Denver are better than our old circuits were to Chicago. Not only are they better, but they are cheaper because with the art as it was two years ago with four No. 8 wires we could get two circuits; now with four No. 8 wires and some coils and insulators we get three circuits of more than double the transmission efficiency. It is interesting to consider what results these cheaper circuits will accomplish when used in connection with the Chicago business. The No. 8 unloaded circuit to Chicago has a transmission efficiency of 34 miles. By the use of telephone relays or repeaters this can be cut down to about 22 or 24 miles. The efficiency of the No. 8 loaded circuits from New York to Chicago is equivalent to about 17 miles of standard cable. The efficiency of the loaded phantom is equivalent to about 15 miles of standard cable. As soon as certain additional circuits via Pittsburg are loaded and phantomed, we shall start using the high-grade circuits for New York-Chicago business.

As I have already stated, there are embodied in the New York-Denver circuit three advances recently made in the art, namely

Loading No. 8 Circuits.

Phantoming No. 8 Circuits, and Combining Loading and Phantoming on the Same Circuits.

The problem of loading No. 8 circuits was primarily a problem in connection with the insulation of

the line wires. A No. 8 circuit can be loaded with the same coils used on No. 12 circuits and these coils would be spaced in the same manner, that is, at 8-mile intervals. It has been a fact known to us ever since we started to do commercial loading that low insulation on a loaded circuit has a much greater effect in impairing the efficiency of such a circuit than the same insulation has on an unloaded circuit. It has also been known that the effect of low insulation on the No. 8 circuits was much more serious than on the No. 12 circuits.

When we first began to load our open wire circuits about ten years ago it was found that the No. 12 gauge circuits which had been loaded gave satisfactory results in dry weather. In wet weather the results were not so good, due to the lower insulation at such times, but these results were good enough. In the case of No. 8 circuits, however, it was found that when they were loaded the effect of low insulation was so serious in wet weather that at such times the circuit was no better than if it was unloaded—sometimes even worse. A system of loaded No. 8 circuits could not, therefore, be considered satisfactory, as it would be a system which part of the time would be better than if not loaded and part of the time worse.

It having been established that a substantial improvement would have to be made in the insulation of No. 8 circuits in order that they might be successfully loaded, and reasonably uniform results obtained from the loading, a study of line insulation conditions was made to determine what steps would be necessary in order to improve the line insulation. Aside from the general insulator leakage two particularly weak points were found in the insulation of open wire circuits. One of these was at transposition points. Diagram 3 shows the arrangement of the wires on a standard single pin transposition. It will be seen that with this arrangement there is a very direct leakage path from one wire to the other during wet weather. The part of the insulator surface protected by the petticoat is the only part that is of much value during wet weather. Actual measurements showed that the leakage on lines equipped with standard single pin type transposition insulators was 20 per cent greater during wet weather than on lines where the two wires were never allowed to be on the same pin. Of course the old standard transposition which employed two insulators, both of the transposition type, and in which the wires were tied to both of them, was just twice as bad as the single pin transposition already discussed. The method of overcoming this difficulty was to transpose the wires without bringing them onto the same insulator. This is accomplished in the manner shown in the second part of Diagram 3, that is, to employ the phantom transposition bracket for transposing a physical circuit. The same problem, of course, arises when phantoms are involved and having used the phantom bracket for the transportation of physical circuits, something else is required when phantoms are involved. This arrangement is also shown in the diagram. By the means described above the transposition as a factor in producing low insulation is eliminated and the transposition points are made just as good as any other point in the line.

Another point at which it was found that there was considerable leakage was where, for the purpose of inserting loading coils, connecting with a test station, or for any other reason, the wires were bridled. These places were particularly bad during wet weather, especially after the bridle wire had been in service for a short time and had weathered. The path of this leakage is shown in part 1 of Diagram 4. The braid on the bridle wire soon becomes weathered and when wet is a fair conductor. Leakage takes place easily over the wet surface at the end of the rubber insulation and thence to the wet braid. This difficulty was overcome by a very neat device known as a bridle wire insulator. Part 2 of the diagram shows a picture of such a bridle wire insulator, and part 3 shows a cross section of it. The two wires shown in connection with this bridle wire insulator extend—one to the loading coil and the other to the lightning arrester. The adoption of this arrangement has completely eliminated low insulation at bridling points.

In addition to the changes at transposition points and at bridling points referred to above, it was thought desirable on the first of these loaded No. 8 circuits to use a line insulator that would be more efficient than our standard glass insulator. After a careful study of insulator design and insulator materials, it was decided to try on these circuits a double petticoated porcelain insulator. Tests on these insulators extending over a period of several years have shown

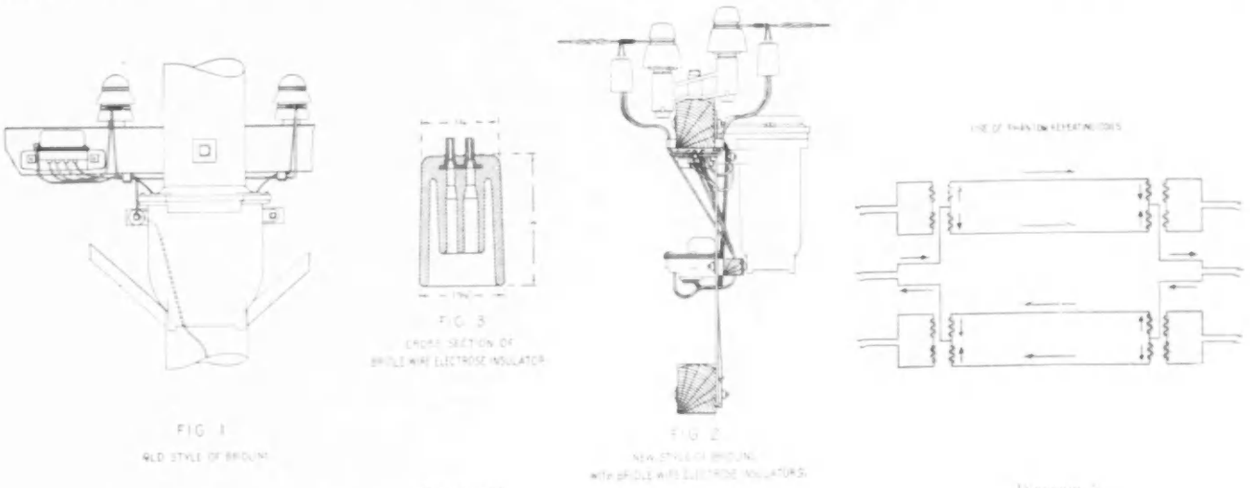


FIG. 1

FIG. 3

FIG. 2

Diagram 4.

Diagram 3.

that the new insulator is several times as good in wet weather as the standard insulator. Part of this improvement is due to the design of the insulator. Some is attributed to the use of porcelain. An objection to these insulators is that they are not so easy to manufacture uniformly, and that each insulator must be inspected, whereas with glass insulators they may be inspected by sample. These porcelain insulators also cost considerably more than glass insulators.

As a result of applying the improvements described above to our No. 8 circuits, it has been found by measurements and tests extending over a long period that the line insulation was at all times sufficiently good to warrant the loading of No. 8 circuits.

PHANTOMING NO. 8 CIRCUITS.

The problem of the phantoming of No. 8 circuits is one in phantom repeating coil design. To meet the special conditions existing in connection with the phantoming of loaded No. 8 circuits as used in our

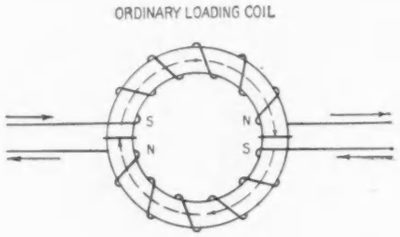


FIGURE 1
Current Flowing in Physical Circuit

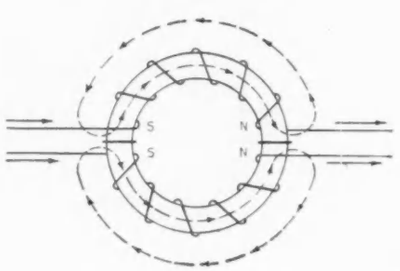


FIGURE 2
Current Flowing in Phantom Circuit

Diagram 6.

plant, it was desirable that apparatus should be developed of the highest posible transmission efficiency. In order to do this the ringing efficiency of the phantom coil was sacrificed and special means for ringing through these coils had to be adopted. In this way and by specially designing a coil to meet the circumstances of these circuits, coils that were suitable were developed. The manner in which these coils are used in phantoming a circuit is shown in Diagram 5.

Up to very recently, while we knew how to phantom ordinary circuits, it was impracticable to phantom loaded circuits because the loading coils so unbalanced the phantom and so increased its effective resistance that a phantom circuit created out of loaded circuits could neither be made quiet nor made efficient from a transmission standpoint. This problem is one of loading coil design. The reasons why ordinary loading coils were unsatisfactory when used on circuits which were to form parts of a phantom will first be stated.

Diagram 6 shows the arrangement of the windings on an ordinary loading coil. The arrows show the direction in which the current flows in the windings at a given instant and the direction of the corresponding magnetizing forces in the loading coil core. If the windings are distributed uniformly over the core, such an arrangement as this produces no external magnetic field. The second part of this diagram shows the same loading coil and the conditions which would exist in it with reference to the telephone current flowing in the phantom circuit. This current, of course, passes in parallel along the two sides of the physical circuit. It will, therefore, magnetize the two halves of the loading coil core in opposite directions. This will produce magnetic poles at the two sides of the core and a great amount of magnetic leakage at these points. The results of this magnetic leakage, which would be different in different cases, would be to make it impossible to get the two side circuits sufficiently alike so as to balance the phantom; would introduce substantial crosstalk due to the stray magnetic field affecting other loading coils, and would bring in serious losses because this stray magnetic field would pass through the solid iron of the loading coil case, bringing in hysteresis and eddy current losses.

In order to overcome this difficulty, it was necessary to devise special arrangements of the windings on the loading coil so that while the coil would still be effective in respect to the current flowing in the physical circuit, the effect of the current flowing in the phantom circuit would be such as not to magnetize the loading coil core. These windings had not only to be balanced magnetically, but also to be so arranged that the electrostatic capacities between the various windings of the coil would not unbalance it. Such coils were devised and are now in successful use on the New York-Denver circuit.

The phantom produced in this manner is, however, not loaded. It is, of course, desirable to load the phantom in order to obtain the benefits of improved transmission on this circuit also. To do this another coil was devised, the windings of which were so arranged that they would introduce inductance in the phantom circuit without affecting the side circuits.

An important piece of work which it was necessary to carry on in parallel with the work dealing with the wire plant, was the development on a satisfactory cord circuit to be used with these very efficient loaded lines. Very successful results have been obtained in this direction, and a cord circuit has been devised on which the transmission losses are almost negligible. With the new cord circuits the loss brought in on the New York-Denver circuit by the two terminal cords at the toll switchboards at New York and Denver and the two intermediate cords at Morrell Park and Omaha is only 0.3 miles of cable. With the old type of cord circuit these losses were substantially greater. The losses with the old cord circuits were equivalent to making the line from New York to Denver 300 miles longer than with the present arrangement.

While the foregoing touches upon the engineering work necessary to successfully construct a circuit which would operate from New York to Denver, another series of problems arose from the fact that we have not now and could not for many years expect to have traffic sufficient to justify three or even one through circuit from New York to Denver. Plans were worked out by which at certain points one or

both of the physical circuits could be cut and made available for way connections without interfering with the use of the phantom on a through connection. Such arrangements are used at several points along the circuit. At other points the physical circuits, and also the phantom, are terminated and are available for connection to any other circuits in the usual manner.

Each of the various functions which we have caused these four wires to perform by the arrangements described above have been obtained in such a manner that no one of them substantially interferes with the others. The maintenance, however, of the circuits—particularly of the phantom—is not an easy proposition, and requires considerable skill on the part of those responsible for it.

I have said nothing in the foregoing with reference to the special construction of underground cable which is required in connection with aerial lines involving loaded phantoms where it is necessary to bring such lines into larger cities. I have omitted this in discussing the New York-Denver line because the cable required for such lines is similar in construction to the Boston-Washington cable which I am now going to describe.

THE BOSTON-WASHINGTON CABLE.

The project of having a complete underground conduit connection from Boston to Washington, and having therein a cable which would insure the service between these points against failure from storm damage, is another of Mr. Vail's great ideas which is about to become a reality.

The underground conduit between New York and Washington is now completed, except for a few miles, and these will be built before the summer. The underground conduit between New York and Boston is to be completed this season. This will make a continuous underground cable route about 475 miles long.

It is proposed to place therein an underground cable, some of the circuits of which will be so efficient from a transmission standpoint that it will be possible to give telephone service between Washington and Boston over these underground conductors. This will be by all odds the longest telephone cable in the world.

This cable itself, and the conduits to provide for it, will represent a very large expenditure of money, and it is an indication of the broad policy which Mr. Vail is applying to the telephone business that he is prepared to take such steps to insure the telephone service between Boston, New York, Philadelphia, Baltimore, Washington and the other points on the route of this cable against failure from storm damage.

The interesting feature of this cable, from an engineering standpoint, is that it is so constructed that practically all of the circuits in it may be phantomed and so that these phantom circuits as well as the side circuits of which they are made up can be loaded.

The loading problem on these cable circuits does not differ substantially from the problem of loading aerial phantom circuits which has already been described. The difficult work in connection with the design and construction of the cable was to have the circuits sufficiently well balanced so that they could be loaded and phantomed without bringing in objectionable crosstalk.

The make-up of this cable is shown by Diagram 7. In the middle of the cable there are 14 pairs of No. 10 B. & S. gauge conductors. Outside of these there are 36 pairs of No. 13 gauge conductors. In the spaces between the No. 13 gauge conductors and the No. 10 gauge conductors, 6 pairs of No. 13 gauge conductors have been put in because there was space for them. At the outside of the cable 18 pairs of No. 16 gauge conductors have been placed because there was room for them. All of the No. 10 gauge pairs and the No. 13 gauge pairs, except the 6 put in between the 10's, are arranged so that they can be phantomed. That is to say, they are arranged in what we call a "quad formation." Each of these quads is built up by taking two twisted pairs and twisting them together, giving due attention to the length of twist employed on the pairs, and in twisting the pairs together. By this construction an arrangement is obtained which can be phantomed, providing certain necessary balances of capacity exist. For example, it is important that the capacity of each wire to the other side of the quad, that is, the other pair, should be the same as the capacity of its mate. To attain this result, care must be exercised in manufacturing to see that the two wires going to make up the pair are twisted together symmetrically, that is, that there is no tendency for one

DIAGRAMMATIC CROSS SECTION OF BOSTON-WASHINGTON CABLE (Outside Diameter 1⅝ inches)

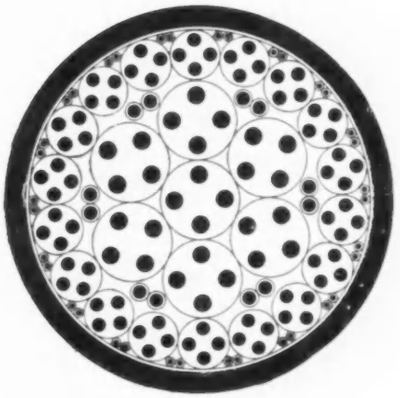


Diagram 7.

wire of the pair to be straight or nearly straight, and for the other wire to spiral around it. In the same way, care must be exercised in twisting up the quad that the two pairs twist about each other evenly.

In connection with splicing up this cable, care must be exercised, not only to see that the wires are correctly joined together, but at certain points tests are made to determine the capacity unbalance of the circuits in two directions, and at these splices to so associate the wires and pairs as to have these unbalances in opposite directions, that is, so that they will tend to neutralize each other.

These precautions are necessary because the transmission efficiency of the cable is so great that crosstalk taking place at a considerable distance from either of the stations at the ends of the cable would be much more audible than in circuits of lower transmission efficiency.

I have already mentioned that the loading coils themselves are of the same general type as those used for loading aerial phantoms and the side circuits of phantoms. Those for use on the No. 10 circuits are almost as big as the coils used for loading open wire circuits. It is necessary to make them of this size in

order to reduce the losses in the coils to a sufficiently small amount. The coils are spaced at intervals of about 1.4 miles, the side circuit coils and phantom coils being placed at the same point. This spacing is determined by the capacity of the conductors, the side circuits having a mutual capacity of about .070 mf. per mile and the phantom having a mutual capacity of about .1 mf. per mile.

The transmission efficiency of these circuits is interesting, and in this connection I may say that while a sufficient amount of this cable has not as yet been manufactured to permit of actual transmission tests on it, so great is our confidence in formulæ for computing these efficiencies which have been developed as a result of our studies and experiments that we are satisfied that the results predicted will be obtained, and the manufacture of about 150 miles of this cable at a cost including loading of about $1,000,000 has been recommended with complete confidence in regard to the results.

The distance from New York to Washington is 235 miles. The most efficient circuits in this cable will be the No. 10 phantoms. These will have a transmission efficiency equivalent to only 13 miles of standard cable. That is, they are nearly twenty times as good as standard cable and decidedly better than unloaded aerial No. 12's. The physical No. 10 circuits will have a transmission efficiency between New York and Washington of 16 miles of standard cable. The phantom 13's—21½ miles of standard cable and the physical 13's—28½ miles of standard cable. These last circuits would not give good service from all subscribers in Manhattan to all subscribers in Washington. They will, however, be very useful from New York to Philadelphia, Wilmington and even Baltimore, and for other combinations such as Philadelphia and Washington. Between Boston and Washington the only circuits that can be counted on for commercial service will be the phantomed No. 10's. These will give a transmission efficiency between test boards of 26 miles. This will be sufficient to insure the service in case the open wire lines are down, although it is not expected that they will have to be used in this way, because it is not likely that there will be so many breaks in the lines that the cable would have to be used at any time all the way from Boston to Washington. All open wire lines are not likely to be down at the same time both north and south of New York City. The cable intersects the open wire lines at numerous points between these two places so that patches can be made at short intervals.

Most of you probably remember the very bad storm which we had the day that President Taft was inaugurated. This storm was particularly severe between New York and Washington, and produced very serious breaks in the overhead line construction in that territory. These breaks seriously interfered with telephone and telegraph service between New York and Washington at a very important time. When the cable is completed this cannot happen again.

The Florida senate has passed the McCreary bill to extend and enlarge the powers of the railroad commissioners of the state so as to give them the exclusive power and authority within the state to regulate charges and service of all persons, firms or corporations carrying on a telephone business within the state of Florida.

A. S. Hibbard to Unify Intelligence Transmission

Plans for a co-operative agreement combining every kind of electric transmission of intelligence—the local and long distance telephone and the telegraph, into one system to "save time," were outlined by Angus S. Hibbard, who recently tendered his resignation as vice-president of the Chicago Telephone Company to become the head of the new concern in New York. The plan embraces the following:

1. Reduction of messengers, who carry telegrams from telegraph offices to the persons to whom they are directed.
2. Use of the telephone to transmit telegrams and long distance telephone messages.
3. Improve the service of telephone and telegraph companies alike by "saving time."
4. Establishing eight operating stations in large cities where this co-operative plan can be carried out.
5. Formation of a combination or "working agreement"—not a "trust"— by which the telephone, long distance and local, may work in harmony with the telegraph companies in the interest of the public and the companies as well.

"Primarily we hope to do away with the novel-reading, cigarette-smoking messenger boy, who shuffles along the street, stopping to peer into the show windows or to watch a fight in the street, for the betterment of the service," said Mr. Hibbard. "We want to avoid needless delays. Telegraph offices will be operated day and night in the future, that a message sent at any time during the twenty-four hours may be delivered promptly. Heretofore messages could not be sent after a specified time, usually 6 p. m., because the telegraph office was closed; or a message received at a given point at a certain time could not be delivered until the following day.

"My duties will be to work in the interest of this plan, and to aid in its development. We have tried the same plan in Chicago during the past three months, and it has worked out to our entire satisfaction, and will be continued and extended."

Hunting a Word for Telephone Messages

The quest of the New York Telephone Company for a single word to mean telephone message, as telegram means telegraph message, has been fruitless so far, but is still going on. Many words have been suggested to the company, but none seems suitable enough to induce the public to take it up and adopt it into the language.

The *Telephone Review*, a paper issued by the company for its employes, says that among the words suggested are phonelog, teletheme, phonetell, phonecall, stellophone, phonomessage, telescript, telelog, bellgram, phonagram, phonegram, phenogram, telcall, telepheme, teletalk, viaphone, vocalgram, fontel.

The objection to phonolog is that it so closely resembles the word phonology.

Phonogram is already in the dictionary and means (1) "A graphic character, symbolizing an articulate sound," and (2) "The tracing produced by a phonograph, from which articulate sounds are reproduced; the speech record of the phonograph; a phonographic message." Phonagram and phonegram are too similar to be acceptable.

Telepheme is already in the dictionary, too, as meaning a telephonic message.

What One Woman Thinks

By Sarah Elizabeth Brown

A LITTLE while ago TELEPHONE ENGINEER printed some corking good stuff telling us countrymen to buy apparatus—that it would never be any cheaper. In justification of your arguments there seemed to me nothing lacking, but you were only theorizing, after all, for we are getting some scandalously low prices right now. By which I mean today. And it seems to be such a good waiting game that we just won't buy now. If six months will save us $2 a set, maybe another six months will save us $4. And, just possibly, after waiting a while longer, should we buy a car of poles, the telephones may be thrown in, one instrument to a pole! Obediah says he can't figure it out how a telephone can be made for so little money. One salesman told him that his company only made telephones on rainy days—that the factory was lugged full of other things—that profit was nix, and that all the overhead expense was taken away from the selling price of telephones and switchboards. Obediah allowed that being such a bully scheme, the force should be increased to three eight-hour shifts and the material expense be cut out as well. Really, it is paying us handsomely not to buy at all, except when we have to. We're smart enough to know that such a campaign won't last long, but it is certainly lasting mighty well, don't you think? But, after all, I'm sure that a telephone is dignified enough, respectable enough, if you please, to have a more substantial price upon it. It represents a business sufficiently large and necessary to mean something more than an article varying in price from the song we sing to get one now, to the price we were soaked for it fourteen years ago. If we took an inventory today, the price per station would range from about $26.75 to the same amount less $20 per station. No possible way for us to "strike an average" at this late date. Well, I mustn't go on like this or I'll have to answer to Obediah, for he hasn't any such fine sentiment in him. If telephones go to a dollar a piece, he'd hem and haw for another nickel. Don't talk to me about women being bargain hunters. And as shy as you care to keep it, don't talk to me about the wisdom of men who slash telephone prices! I happen to know that when the overhead expense of making and selling telephones is cut out there will be a shaking of dry bones in the not distant future. We can't get milk from our cows by feeding 'em sawdust.

* * *

Have you been able to figure out that new plan of Bell organization that I mentioned last month—the big thing that has Chicago for headquarters and which is to exercise authority over five of the central states? I haven't. I can't see a single economy, anywhere. I am always intensely interested in nearly every big thing—from the fish that gets away to the baby elephant, but the newest, unnamed, territorial shebang that has been evolved by the Bell has me going southwest. They call it an operating unit for want of a better name, and listen: A population of 18,250,000 and 1,250,000 subscriber stations. A territory of approximately a quarter by a million square miles, including cities. The investment of the "unit" is about $100,000,000, and the gross annual business is set down at $25,000,000. There are over 23,000 employes. Ho, hum, that's a unit all right; not an atom.

* * *

But speaking of big things, did you grasp the significance of the A. T. & T. report figures? Cost of operation, $54,000,000; current maintenance, $25,700,000; for depreciation, $26,200,000. The item of taxes, about $20,000 a day! And a total capitalization of $1,114,310,979.00—the cents' cyphers are added to make a ripping sum! Well, I'm sufficiently intoxicated with the things I can't comprehend, to change the subject. But, goodness knows, the telephone business will surely not be classed as an infant industry very much longer, will it?

* * *

The Chicago *Inter Ocean* of May 7—that paper you city folks know so little about, and which we country folks have been reading for thirty years—printed the first public statement ever issued by the Kellogg Switchboard & Supply Company. It is a good report—good, because it doesn't capitalize its good-will or its patent account. Kellogg assets mean plant and plant equipment, which are placed at $744,864. The inventory reaches above the million mark. The company is capitalized at $1,000,000, and after paying the year's dividend, which please note—capital stock, $497,000; cash, $110,000—there was a surplus of $1,211,728. The statement is for the year ending December 31, 1910. Got any of this stock?

* * *

Among other paying independent telephone institutions is the Interstate of Aurora. Regular mysterious stranger at that, but figures are truthful most of the time. Since November, 1910, till May 1, 1911, the earned net surplus was equivalent to three per cent on the company's outstanding stock of nearly two and a half million dollars. I think that's a pretty good showing for a cripple.

* * *

Are we to believe that George R. Fuller, that old fighting independent, is being correctly quoted when we read: "Said defendant denies upon information and belief that it is to the public interest that competition should be maintained and continued in the telephone business"? Or must I get my glasses refitted to my eyes? The statement I have quoted is alleged to have been brought out at the Rochester injunction proceedings in the present squabble between the Bell and independents. You haven't forgotten that the Friendship Company, doubtless acting for the Bell, was a considerable purchaser of independent telephone securities at Syracuse, Utica and Rochester before there was much excitement in those vicinities. Syracuse and Utica seem to have gone over and Rochester is saved, but there is a row on. It was Bert Hubbel and his Federal company at Buffalo who put the emery on the bearings, and now we'll have some more attorney fees. But would George say a thing like that, even in a rough-house?

* * *

Out of the east came a rumble in February that until the Standard Oil and American Tobacco cases

were disposed of by the United States Supreme Court, there would be no country-wide merger between the Bell and independent interests. This bit of gossip was due to the Yount telephone bill in Ohio. The Morgan holdings in that state and the location of Morgan's office in Wall street. All right, the Standard Oil case is settled and everybody knows about it. The stock went up the very next day. So did American Tobacco stock go up. It's like that old song Walter Doolittle specialized in—"The smoke goes up the chimney just the same." So get ready for that far-flung, country-wide merger thing, right away. The Yount bill died with the Ohio legislature's adjournment, but the Giles' bill in Michigan was signed by Governor Osborn, May 4. Michigan is ready; but Wall street isn't; or is it Wall street is ready and Michigan isn't? Awfully exciting—this telephone business. I hope everybody gets as much fun out of it as I do.

* * *

I see that the Utah Independent Telephone Company is to be sold at auction June 5. That is something else again, yet, as Maurice would say to Abe, selling a telephone system as big as Salt Lake's independent on the block doesn't happen every day. The company is capitalized at a million dollars and there is about two and a half times that amount in bonds and about 15,000 subscriber stations. It is claimed that a banker in Jersey City dominates the holdings and he wants to get his money. The auction method will give everybody a chance. Speculation is rife that the Bell has owned the property for a long time, but both the Bell and independents deny this. It is believed, however, that on June 5 the purchaser will effect a readjustment of conditions of operation and administration and go right ahead with the property. To do this will require an increase in rates—something that the franchise or the council interferes with under the present arrangement.

* * *

A German inventor in Detroit is getting a lot of publicity for his invention of a telephone that will talk as far as a circuit can be equipped. It is described roughly as a "new style, primary current, direct connection" instrument, capable of doing miraculous stunts. Everybody must get this new thing right away or be overrun by the wheels of progress. The inventor believes he can talk to London without half trying, using the cables, of course. I am making this record here because I'm sure a technical editor would overlook anything so important!

* * *

Stromberg-Carlson's stock is still booming on the Rochester exchange. Part of the activity is inspired by a dividend of $3.50 per share that was paid stockholders May 10. The telephone business seems to be prospering in spite of the negotiations that have interfered with it since early in the year.

* * *

In Kansas the Bell cannot acquire by purchase, lease or otherwise, any property that would be unlawful for it to hold under a new law relating to public utilities passed by the recent legislature. Needless to say that this new law prohibits the absorption of competing systems. The telephone business may be a natural monopoly from a single point of view, but it is hard work to get a lot of people to believe it. One state says, "Go ahead and merge," and another state says, "Keep up the fight." I'm thinking it will be years and years before we have a unified system.

* * *

Over in Ohio there is a little country town, with its churches, its school, its bandstand on the main street for the regular Saturday night concert, its miscelianeous shops and stores. It isn't different in essentials from hundreds of other little country towns. But there is a man down there—a minister, who has undertaken to incorporate a company; issue stocks to the merchants for their stores; retain them as department managers; advertise, audit and do business. If the scheme goes through, and it begins to look like it might, the incorporated town will have all the earmarks of a trust. If you want to go there and sell shoes, you will have the hardest game of your life. Shoes will be cheap at the trust town while you are there and hardware and dry goods high—to take care of the loss on shoes. When this scheme is aired before the Supreme Court, will the decision call it "reasonable," or "unreasonable"? Maybe you can follow me in my opinion, which never amounts to a great deal. And after while we will find the decision in telephone matters as tame as Standard Oil. The telephone system of the United States will remain practically as it is for a generation or three. The big cities will yowl about a dual system and there won't be any cause for a like complaint in the country. Independent companies who have been charging an ample rate will grow and expand and serve without interference. My brothers, this is a terribly big country, and as I have repeatedly hinted, no one concern will ever run its telephone business. I don't believe any one concern wants to run it. There is room for the operators and dealers and makers—lots and lots of room. We're a long ways off from the saturation point in this country and beyond the seas are other countries with other peoples, and I'm told that the telephone systems are far from being good.

Women Telephone to Pets

Overcome by desire to hear the notes of her parrot's voice, Mrs. W. H. Walt, a society leader of Atlanta, Ga., while on a visit in Cincinnati, employed the long-distance telephone to converse with her feathered pet in Atlanta. When connection had been made between Cincinnati and Atlanta, polly was perched near the mouthpiece while a servant held the receiver to its ear.

When Mrs. Walt spoke, polly responded. It talked quite freely, becoming garrulous, in fact, and no one seemed to enjoy the conversation more than polly.

The connection was just a little bad, however, and polly never seemed to catch the exact drift of the conversation. It punctuated its remarks fully with such expressions as "Hello!" "Well!" and other similar ejaculations.

Other members of the household could not get the other side of the conversation, but they think from the expression on polly's countenance it ran much to "doll baby" and other endearing terms.

Incidentally the conversation cost $30. It was worth it, according to Mrs. Walt and polly, but Mr. Walt expressed himself differently.

Officials of the Chicago Telephone Company state that it is by no means uncommon for people, women especially, to call up their homes and talk to their cats, dogs and parrots.

The Telephone Scrap Book

Government Stations at Washington

THE diagram indicates a part of the service which the Chesapeake and Potomac Telephone Company furnishes to the United States Government at Washington, according to the *Telephone News*.

The government has thirty-eight private branch exchanges, thirty-five of which are connected to central offices with from two to fifty trunk lines, while the remaining three obtain their service exclusively

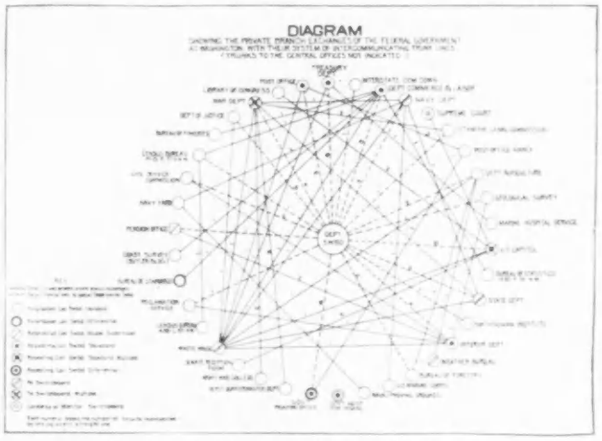


Diagram of Government Lines at Washington.

by means of tie lines to other private branch exchanges. Thirty-five of these thirty-eight switchboards are connected together by means of direct "tie lines" which aggregate forty-nine circuits. Twenty of the private branch exchanges have from one to eight "departmental lines," the total number being fifty-six, which lines connect with a central switchboard established for the purpose of providing quick communication from each of the several departments and bureaus to a greater number of other departments and bureaus than can be reached by the direct tie lines. This system of inter-connected private branch exchanges, which is the result of a growth of more than a decade, is the most extraordinary and most complete system of its kind in the world, and satisfactorily meets the requirements peculiar to the case. A glance at the diagram will show that the president of the United States can talk to the secretary of state, secretary of war, secretary of the navy, secretary of the Interior, secretary of agriculture, secretary of the treasury, secretary of commerce and labor, the attorney general and the postmaster general at their respective offices, or can reach the president of the senate, or the speaker of the house of representatives at the capitol by means of direct tie lines; again the secretary of the interior can communicate with the civil service commission by means of a direct tie line, or if this should be in use, through the "department switchboard"; and this failing, of course he still has the regular channel of communication by means of the central office trunk lines which serve the two switchboards.

These government switchboards vary in size from a seven-line "monitor" switchboard to a board of the central office type of ten operators' positions. The number of central office trunks varies from two to fifty. The largest and the smallest of the private branch exchanges are at the capitol, the former being the general telephone switchboard in connection with both branches of congress, and the latter being the private branch exchange in the United States Supreme Court, and having the very appropriate call number, "Main 1."

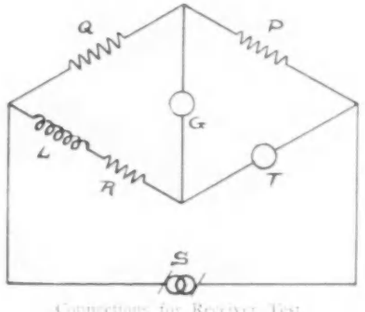
For the benefit of anyone who may not understand the term "differential switchboard," it is explained that this consists of a private branch exchange at which certain designated stations obtain both local and exchange service, while the remaining less important stations can be given local service, but by means of a special feature in connection with the trunk lines and cord circuits, cannot obtain service over trunk lines to the central office. This type of service was developed at Washington about seven years ago in order to forestall the installation of an independent interior system in one of the large government buildings, and being entirely successful, was adopted by a number of the other branches of the government, but is now gradually disappearing as the government officials are coming to figure more and more on what telephone service saves, rather than on what it costs.

Telephone Receiver Efficiency

MEASUREMENT of the efficiency of a telephone receiver is difficult because of the infinitesimal quantities involved. Greenleaf W. Pickard describes in the *Electrical Review and Western Electrician* a method used by him in making such measurements. The receiver diaphragm is held so that it cannot vibrate by immersing it in stiff vaseline. This disposes of the factor of energy transformed into diaphragm vibration, and the other current losses and transformation being constant can be determined.

The circuit employed by the writer is shown in the diagram herewith.

Q and P are two equal resistances, of about 100 ohms. L is a variable inductance, of sufficient range



Connections for Receiver Test.

to include the inductance of the instrument under test, and R is a variable resistance. A telephone receiver G is used in place of the ordinary bridge galvanometer, and alternating current from a suitable source S energizes the bridge network. The telephone receiver to be measured T, is balanced against L and R. If the current supply is truly sinusoidal, an extremely sharp

balance, indicated by practically no sound in *G*, is obtained by the adjustment of *L* and *R*.

This measurement is first made with the receiver *T* in normal condition, with the diaphragm vibrating freely, and then repeated with the diaphragm immobilized. Two values are thus obtained for the effective resistance, one including the dissipation of energy from the vibrating diaphragm, and the other exclusive of this source of loss. The difference between these two effective resistances, divided by the larger resistance, is the efficiency of the receiver.

As an example of the method, the measurement of a thirty-ohm telephone receiver is tabulated below.

Steady current resistance	31.74	ohms.
Inductance at 500 cycles, diaphragm free	21.0	millihenrys.
Effective resistance, diaphragm free	71.2	ohms.
Inductance, diaphragm immobilized	20.6	millihenrys.
Effective resistance, diaphragm immobilized	67.6	ohms.
Difference	3.6	ohms.
Efficiency	5.06	per cent.

As the efficiency varies with the frequency of the alternating current used, a complete study of a telephone receiver would of course involve similar measurements with a number of different frequencies, so chosen as to fairly represent the range of telephonic frequencies.

Reinforced Wood Poles

FEBRUARY SCRAP BOOK contained an account of how poles weakened by decay at the ground line are mended with concrete. We are informed by the Pittsburgh Reinforcing Pole Company that the method of reinforcing used on the poles in the test there described differs considerably from the present method, and is much inferior in strength.

Fig. 1. Reinforced Butt After Breaking Test.

On the poles used in that test the reinforcing rods, with one exception, were all imbedded in the pole beneath the concrete collar, and on none of the poles was expanded metal used, which is now specified for every pole, and is a very important element of the reinforcing. At the present time at least half the rods are imbedded in the pole above the concrete collar, in which position they afford considerably more strength to the pole, and are attached to the pole at the point above the line of decay, where the condition of the wood may be easily determined.

In a test of reinforced poles made by the Allegheny County Light Company a new chestnut pole was weakened 75 per cent at the ground line and reinforced. A new pole was used in order to put the maximum strain on the reinforcement. It is calculated that this pole in its original unweakened condition would have broken at a pull of 2,425 pounds applied 27 feet from the ground. After the pole had been weakened and reinforced it broke under test at a pull of 2,800 pounds applied 27 feet from the ground, after deflecting over 9 feet. This test is representative of what reinforcement process can do.

Fig. 2. Applying the Reinforcement.

This pole was reinforced with 10 steel rods 6 feet long. The rods were driven into the sound butt 2½ feet below the ground and then bent out until the diametrical distance at the ground level was about 24 inches. The upper ends of the rods were driven into the pole 28 inches above the ground. A concentric collar of expanded metal was then placed over the rods and ground into the soft concrete at the base several inches and allowed to extend several inches above the tops of the rods. The concrete collar was carried up sufficiently high to enclose all metal work, as shown. Twenty cubic feet of concrete was used below ground and 7½ cubic feet for the collar. This method of reinforcement enabled the pole to withstand a strain of 2,800 pounds previous to rupture, the pole breaking slightly below the top of collar practically at the point of the upper anchorage of the rods.

In these tests, due to the soundness of the poles, the test really was one of various applications of the reinforcement and the higher results obtained show to what extent this reinforcement might be carried to meet exceptional conditions, such as the strengthening of corner poles and poles where no guy wire or suitable anchorage can be obtained. The use of expanded metal is intended primarily to increase the strength of the collar and prevent injury from mechanical causes, but its use seems to add considerable strength to the reinforcing and for requirements greater than the average, expanded metal should be used.

The general method of reinforcing old poles is the principal point of interest as it is in the reclaiming of such poles that this process will be of greatest value.

The reinforcement shown in Fig. 1 is that which stood a pull of 2,000 pounds at a distance of 27 feet from the ground before breaking. This put a strain of 75,000 pounds on the reinforcing collar and after the pole had broken the reinforcement was intact. The extreme deflection of the pole, which was nearly ten feet, caused some of the concrete above the expanded metal to scale off. The strength of the reinforcement was unimpaired. The other photograph, Fig. 2, shows the decayed condition of a pole before reinforcing.

In some reinforcing done at Elmira by the Postal Telegraph Company, the poles reinforced were all large sticks from 55 to 70 feet high, some of which were entirely decayed at the ground line. The cost of reinforcing large poles such as these is considerably more than in the case of 30 or 35 foot poles. The reinforcement in this case cost about $7.50, where a proportionally strong reinforcement for 35 foot poles would cost about $3.50. The money saved by the reinforcement is evident when it is considered that the cost of replacing these old poles, change over of wires and cross arms incident thereto would have amounted to not less than from $40 to $50 per pole. The money saved averages about $40 per pole. The pole is stronger than ever at the ground line, and can be continued in service indefinitely.

Direct and Alternating Current Magnets

CONSIDERABLE discrepancies have often been noticed between the pull exerted by an electromagnet when excited with direct current and that exerted by the same magnet (or one of the same dimensions, only modified to avoid eddy-current losses) when used on a single-phase alternating-current circuit at the same current, says P. R. Friedlaender in the London *Electrical Review*.

In many cases, no doubt, this is partly due to the effect of iron saturation, but, quite apart from this factor, considerable differences still occur.

Suppose a certain electromagnet is employed to attract an armature, with a certain weight attached, across an air-gap of length L. A certain direct current A is found to cause the armature just to lift. If, now, an alternating current of $A \sqrt{M S}$ amperes is applied instead of the direct current, with the arma-

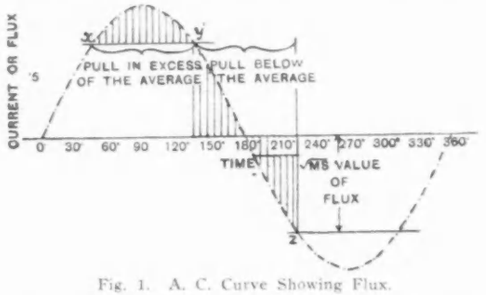

CURRENT OR FLUX
PULL IN EXCESS OF THE AVERAGE
PULL BELOW THE AVERAGE
0 30 60 90 120 150 180 210 240 270 300 330 360
TIME
MS VALUE OF FLUX

Fig. 1. A. C. Curve Showing Flux.

ture set at the same distance L, the pull on it will vary from 0 to a maximum and back to 0 twice every period. Assuming a sine wave of current and quite unsaturated iron, the maximum pull will be that corresponding to a current of $\sqrt{2} \times A$ amperes, or a flux density of $\sqrt{2} \times$ the D. C. flux density, and, as the pull increases as the square of the flux density, the maximum instantaneous pull on A.C. will be $2 \times$ pull on D.C. During the intervals of high pull (from x to y in Fig. 1), the attractive pull of the magnet will be in excess of the load on the armature, and the armature will consequently lift more or less rapidly, according to the mass to be accelerated, and will approach the poles slightly. During the intervals of low pull (y to

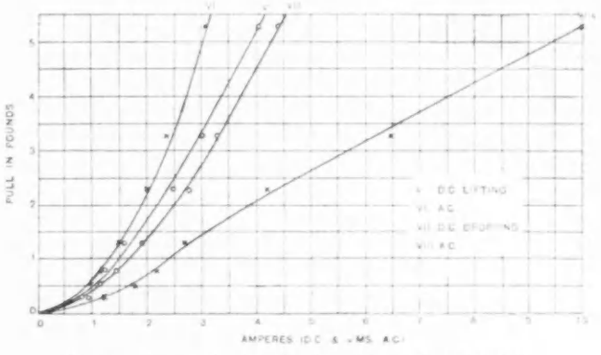


Fig. 2. Curves Showing Results with .04 Inch Air Gap.

z, Fig. 1) the attractive pull is *less* than the load on the armature, and, consequently, the armature tends to move away, and is only prevented from doing so by the stops used to set the air-gap at length L to begin with. As any *increase* in L is thus rendered impossible, the net result over the whole period is equivalent to the use of a steady air-gap length somewhat less than L. Consequently, the pull with A.C. is somewhat greater than with D.C.—the exact excess depending on: (1) the mass of the armature and load; (2) the shape of the time curve of flux on A.C.; (3) the actual value of L, *i. e.*, the percentage change in flux produced by a given small change of air-gap length; and (4) the frequency.

If, on the other hand, the armature is separated from the poles by fixed, non-magnetic, distance pieces (or is tight up against the poles), and the problem is to determine at what current the armature will be released, the effect of using A.C. will be the reverse of the above, *i. e.*, the pull on A.C. will be less than on D.C., with the same current values. For now, during the periods of excess pull (x to y, Fig. 1), the armature cannot approach the poles and reduce the air-gap L, because of the distance pieces, but during the intervals of low pull (y to z, Fig. 1) the armature is free to move away, so that the net effect over the whole period is to give an effective air-gap with A.C. somewhat greater than the fixed air-gap L, with D.C.

With a .04-in. air-gap and 3 amperes, the ratio is .71 when lifting and 2.1 when dropping. With an air-gap of .187 in. and 8 amperes, the ratio is .88 when lifting and 1.35 when dropping. It will be seen that the difference between the A.C. and D.C. pulls gets steadily less as the air-gap length increases, owing to the diminishing percentage effect of a given fluctuation in air-gap length.

A greater difference between the D.C. and A.C. pulls is found in the dropping tests than in the lifting tests, probably due to the fact that, in the lifting tests, the possible momentary reduction in air-gap is limited by the length of air-gap under test; whilst in the dropping tests, the possible momentary increase in air-gap was not artificially limited in any way—the adjusting screws being set well back.

Experiments with a small laminated horse shoe magnet gave results as partly indicated by the curves in Fig. 2, the air-gap in this case being .04 inch. The curves show results in both lifting and dropping tests.

Damaged By Storm

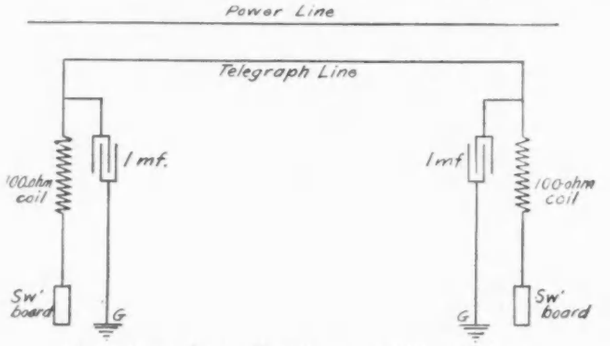
THIS photograph was taken at Bloomfield, Neb., May 3, and shows some of the damage caused by one of the worst storms that has visited that region in years. The storm followed twenty-four hours of

Effects of a Nebraska Storm.

rain. The photograph was sent us by J. H. Gesler, manager and secretary of the Union Telephone Cobpany at Bloomfield. The company operates also at Wausa and Crofton.

Disturbances between Telegraph and Power Lines

DURING the past winter a high tension power line was constructed adjoining our right of way for a distance of fourteen miles, says E. D. Hubbard, general foreman of telegraph, Grand Trunk Railway System, Battle Creek, Mich., in the *Telegraph and Telephone Age*. As this line was of steel tower construction with suspension insulators designed to carry 100,000 volts, and was only to carry a 40,000-volt, 60-cycle,



Eliminating Inductive Disturbances on Telegraph Lines.

three-phase current, no trouble was expected, since similar lines at other points had caused no interference.

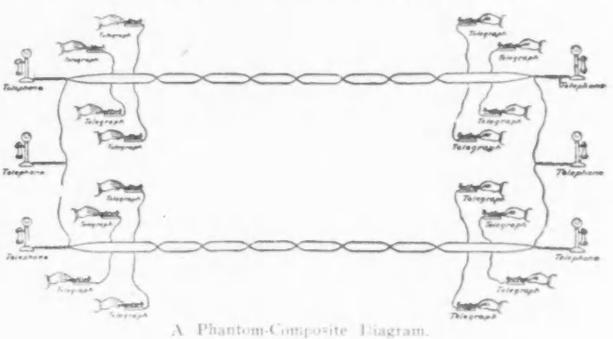
When the line was finally completed, and the current turned on, all of our single Morse wires were badly affected. All relays were set to chattering and could not be adjusted so as to overcome the disturbance and still respond to the telegraphic impulses. The power company claimed that its lines were perfectly balanced, free from grounds, and that it could not cut in transpositions in its lines without constructing extra towers.

It being necessary to clear the trouble from the telegraph wires as quickly as possible, retardation coils were placed in the telegraph circuits at the first stations each side of the exposed section and condensers were bridged from lines to ground between the coils, as shown in the accompanying illustration. This removed the trouble entirely and the telegraph circuits apparently worked as well as ever. One hundred-ohm retardation coils and one-microfarad condensers were used.

Telephone-Telegraph Transmission

CIRCUITS like those shown in the accompanying diagram are in daily use between New York and Chicago. They carry simultaneously three telephone conversations and eight telegraph messages without interference. As the drawing well shows, this remarkable result is achieved by the use of two complete metallic circuits. Each of these circuits is quadruplexed for the telegraph, thus giving the eight messages; while a telephone phantom circuit is imposed on the two physical circuits, making the third telephone circuit.

This extensive use of two sets of transmission wires marks an example of the high efficiency which



A Phantom-Composite Diagram.

it is possible to obtain through a judicious combination of telephone and telegraph properties. The imposing of telegraph on the telephone allows a practically continuous use of the circuits, which results in reducing the cost of long distance telephone transmission.

The diagram is taken from page 48 of the annual report of the American Telephone and Telegraph Company.

Telephone Project for Alaska

The Seward Telephone Company has started work on the installation of a telephone line from Mile 79 on the Alaska Northern Railroad to the Iditarod, Alaska. A connection will be made by the two lines at Georgetown. It is calculated that the work will be completed before September next, at which time the Iditarod will be in direct communication with the great metropolitan centers of the United States. Under the present circumstances the residents of the town have a mail which leaves for the outside once a month, travels about 1,500 miles out of the direct line and with the help of Providence and the mail carriers it finally reaches its destination.

Semi-Automatic Method of Handling Traffic

By Edward E. Clement*

STATED broadly, the automanual telephone system is a combination of the manual and automatic methods which contemplates (1) centralization of automatic apparatus; (2) the employment and concentration of operators; (3) correct subdivision of a system for traffic handling.

Fig. 1 is a simplified skeleton diagram showing the general lay-out of an automanual exchange equipment having a capacity up to 10,000 lines. In this diagram five subscribers' lines are shown, one of which is a five-party line, two others are four-party lines, and the remaining two are individual lines. Ringing is supposed to be five party selective.

In this diagram, for the sake of clearness, only the most elementary forms of apparatus are shown. The switches, however, are supposed to represent two-motion, one-hundred-point, electromagnetically-driven step-by-step automatic units, of uniform type. Percentage trunking is employed throughout the system shown, and the switches are equipped with banks containing ten vertical rows of ten contact pairs each. The motion is around and up, this precedence of the rotary motion affording certain advantages. The entire system is built up of interchangeable units.

In Fig. 1 the circuits have been laid out so as to show in a simple way the analogy between this system and a manual switchboard system, the same operations being performed in the same manner throughout, but automatically instead of manually. For example, the subscribers' lines terminate on primary selector bank contacts which correspond to the answering jacks of the manual board, and they are

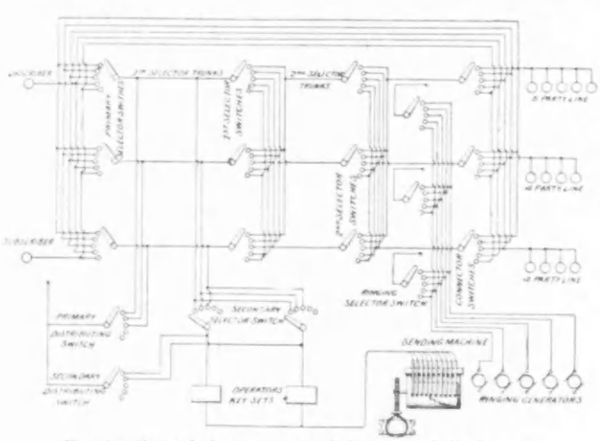


Fig. 1. General Arrangement of Automanual Exchange.

also multipled to calling contacts in the banks of the connector switches, which correspond to the multiple jacks on the manual board.

The wipers of the primary selector switches constitute the equivalents of plugs which co-operate with the subscribers' answering jacks, but are mechanically driven thereto instead of by the hand of an operator. The first selector switches similarly correspond to the calling plugs of manual pairs, and the first selector trunks extending between the primary and the first selector switches are the equivalents of the cord circuits. The second selector and connector trunks are the same as trunk lines between different positions on a switchboard, the method of switching at each step corresponding to the selective insertion of another plug to add another link in the connection by a manual operator. The secondary selector switches constitute the equivalents of the operators' keys as-

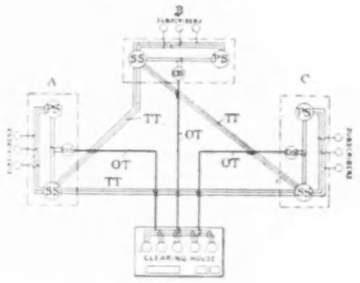


Fig. 2.

sociated with the cord circuits, and the sending machine operated therethrough sends impulses to work the selector and connector switches, instead of spoken words to direct an equivalent number of successive operators. The primary distributing switch performs the function of the operator's mind in selecting an idle cord circuit for any given connection, and the secondard distributing switch is the equivalent of a monitor distributing calls among the operators, by directing each one of them when to answer.

The ringing selector switches take the place of the selective buttons of *B* or trunk operators so that the selection of the desired generator to ring a particular subscriber is directed by impulses from the sending machine, instead of by spoken words proceeding from the original or *A* operator. To complete the analogy, the releasing means for all the switches when in service are controlled by the connected subscribers, thus corresponding to the supervisory signals, by which in a manual system the subscribers can instruct the operators to clear out.

All subscribers' lines are represented by terminals in the primary selectors and in the connector banks, and while the method of trunking shown is only a contributory feature of this lay-out, the diagram will be fully described, for the benefit of those who may not be entirely familiar with this class of circuits. I might state in passing that there are a great many features of special design in the automanual circuits, but they involve so much detail that the limits of the present paper do not permit my presenting them at this time.

The progress of a call is from the calling subscriber through an idle primary selector, which becomes automatically attracted to his line, and thence through a secondary selector, similarly attracted, to an idle operator. Under no conditions is this departed from. The principle is that the operator should

*Abstract of paper presented at Pacific Coast meeting of the A. I. E. E., April 25-28, 1911.

be brought into direct touch with the subscriber at the very outset, precisely as in a manual system. Having ascertained the number, the operator sets up this number on her key set and sends impulses through her circuit to the first selector, second selector, connector and ringing selector switches, thus establishing the wanted connection and also starting agencies in the connector circuit which continue thereafter automatically to ring until the called subscriber answers or the calling subscriber hangs up the receiver. After initiating the call, the calling subscriber's

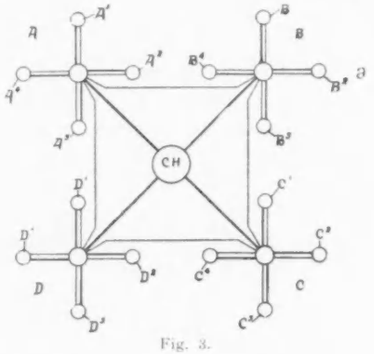


Fig. 3.

line is connected through the primary and secondary selector switches to the operator in every case, and, further movement of a subscriber's hook or the repeated opening and closing of the circuit, will not reach more than one operator, and cannot disturb general traffic conditions. This happens sometimes through change of purpose or the like, and it is highly essential that the automanual operator should not experience the slightest delay, nor pay attention to anything except the rigid rule of getting the number and setting it up. After the operator has answered the calling subscriber is given full control of the connection, and can clear out and release all of the apparatus at any time up to the moment when the called subscriber answers. Thereafter, the called subscriber assumes control of the connector switch, which he can release so as to clear his line by merely hanging up his receiver. This prevents tying up the called line.

When the operator connects the sending machine to the switches, through her key set, impulses are sent in groups corresponding to the several keys depressed, that is to the number wanted, as well as to the number of the generator required to ring the wanted party, if it be a party-line. The first group of impulses steps around the first selector switch to pick out a group of second selector trunks, and an idle trunk in that group, leading to the wipers of the second selector switch. The second group of impulses works this second selector switch to pick out a group of connector trunks. and an idle trunk in that group, terminating on the wipers of a connector switch in whose banks appear the terminals of the wanted line. Successive groups of impulses are then transmitted to step the connector wipers around and up to the wanted line terminals.

Fig. 2 is a diagram showing the "clearing-house" connected to three exchange switching centers, *A, B, C,* directly connected by talking trunks *T T* shown in light lines, and all connected to the clearing-house by special or operators' trunks *O T* shown in heavy lines. At each of the exchange centers three subscribers' stations are shown connected to the primary selector switches *P S*, and the selective switches *S S*. The operators' trunks have secondary selectors *O S*, containing in their banks terminals for the primary selector links. At the clearing-house the operators' trunks *O T* are arranged for distribution among the operators' key sets in a manner similar to that shown in Fig. 1. It will be observed that the talking trunks *T T* between exchanges, which carry the traffic load, are absolutely independent of the operators' trunks, and have no relation whatever to the clearing-house. The operators' trunks are worked at 100 per cent efficiency all the time, each being tied up for any call during a period of a few seconds only while the wanted connection is being established and being then free to take on another call and so on. The number of these trunks required to any switching center is proportional to the originating traffic therein, and would usually be less than one per cent of the number of lines terminating at that center. The course of a connection may be traced as follows:

Suppose a call to originate with the first subscribers' line in the exchange *A*. This is automatically connected to an idle primary selector switch, *P S*, thence through the link of that switch to an idle secondary selector switch *O S*, and an operators' trunk line *O T* to an idle key set at the clearing-house. Thus the calling subscriber is confronted by the operator at the instant of his access to the first piece of apparatus, that is the primary selector in his own exchange, in the same manner that he would be confronted by a manual operator physically present in that exchange. The operator in this case having ascertained the number wanted, sets it up on her key set and presses the starting key. Impulses are then transmitted from the sending machine at the clearing-house, out over the operators' trunk, through the secondary selector at exchange *A*, to the first selector switches of the set *S S*, which is permanently connected to the primary selector *P S* to which the calling subscriber is temporarily connected. The impulses

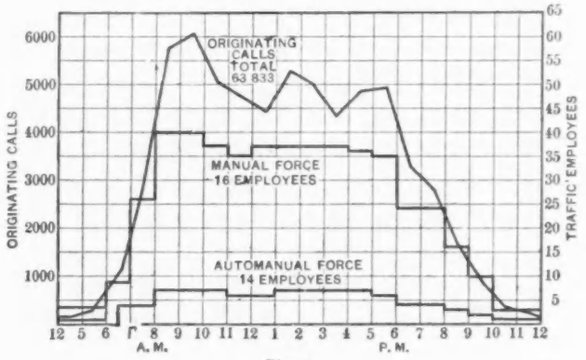


Fig. 4.
Erratum: For Manual Force read 61 employes instead of 16.

corresponding to the first digit of the number cause the first selector switch *S S* to select a local connector or selector, or a trunk leading to the desired exchange, which we will assume in this case to be *B*. The trunk terminates there in a second selector switch *S S* and the impulses corresponding to the next digit cause this second selector to pick out either an idle connector containing the line wanted, or an idle third selector through which the conector can be found by a fourth set of impulses, depending on the size of the exchange *B*. As soon as the connection is completed,

that is to say, as soon as one complete cycle or set of impulse groups have been transmitted from the sending machine, its connection with the operators' key set is automatically opened and the secondary selector *O S* at the originating exchange, *A*, automatically drops off and disconnects the operators' trunk, being immediately thereafter available for another call. Thus, the operators' function having been fulfilled, in accordance with the rule hereinbefore stated, with the least expenditure of time or energy by the operator, she is instantly relieved, free to take another call, and the control of the connection

cent of all calls (flat rate) are trunked. The calls handled during the busy hour in both exchanges average about 185 per manual operator.

It will be noted that the manual "B" or trunk operators and the trunk calls are omitted from this chart. The automanual makes its greatest saving where branch exchanges are employed; the heavier the trunking, the greater the saving with automanual because it eliminates trunk operators. Notwithstanding that the chart deals only with "A" operators, a reduction in employes in favor of automanual amounting to 77 per cent is nevertheless effected.

A.M.								P.M.										NO. OF OPRS.	REMARKS
12-5	5-6	6-7	7-8	8-9	9-10	10-12	11-12	12-1	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	9-10	10-12	11-12		
AUTOMANUAL OPERATORS SCHEDULE																					
1	1	1	1														1	1	1	1	
		1	1	1	1	1		1	1	1	1									2	
		2	2	2	2	2		2	2	2	2	2								1	
			1	1	1	1	1	1		1	1	1	1							1	
				1	1	1	1		1	1	1	1	1							1	
				1	1	1	1	1		1	1	1	1	1						1	
				1	1	1							1	1	1	1				1	
							1	1	1			1	1	1	1					1	
							1	1	1				1	1	1	1				1	
								1	1	1	1	1		1	1	1	1			1	
																				1	DAY CHIEF
																				1	EVE. "
																				1	RELIEF OPR.
5	1	2-4	4	7	7	7	6	6	7	7	7	7	6	4	4	3	2	1	1	14	NUMBER OPERATORS
508	232	1027	2845	5870	6074	5061	4728	4439	5271	4598	4229	4929	4431	2806	2805	1623	816	314	238	63 833	ORIGINATING CALLS
508	232	342	711	838	867	723	787	723	753	657	603	704	822	826	701	541	408	314	238	671	CALLS PER OPR.

Fig. 6.

through the talking trunks and switches remains entirely with the connected subscribers. When they hang up their receivers, all the switches are instantly cleared out, and ready for further use.

Fig. 3 shows the clearing-house principle applied to a sub-divided system having four districts, *A B C D*, the first of which has sub-centers *A1 A2 A3 A4*, the second sub-centers *B1 B2 B3 B4*, and so on. The

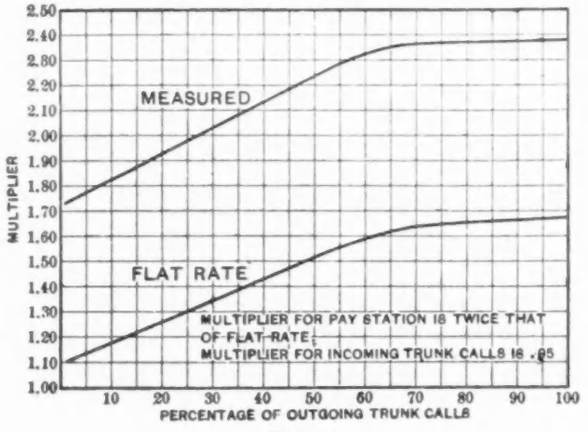


Fig. 5.

clearing-house *C H* is connected through operators' trunks *O T*, the method of handling calls being the same as that explained in connection with Fig. 2.

A comparison between a manual and an automanual operating force in handling a traffic load is shown in Fig. 4. This traffic load represents 4162 working lines connected with a main and a branch exchange located in a western city. About 21 per

For comparing costs in handling traffic a standard unit is necessary by which every manual system may be measured and for this unit is employed the flat-rate non-trunked call as it appears in a common-battery multiple switchboard, and for convenience in comparison the cost of handling 1,000 such calls is used as a basis.

Calls other than flat-rate, non-trunked calls require equalizing in accordance with the ratio of effort and time consumed, which is easily accomplished by the use of the multiplier given on the left margin of the curves shown in Fig. 5, as indicated by the point of intersection between the curves and the vertical line corresponding to the previously determined trunking percentage.

Having equalized the calls in accordance with the tables, then divide the total present daily operating expense by the number of such daily equated calls and place the decimal point to show the cost per thousand equated calls.

A comparison can then be made between the cost per thousand equated calls thus arrived at and the cost shown in curves of Fig 5. At a first glance the multiplier of 95 for incoming trunk calls appears to be rather high, but this is explained by the unavoidable loss in efficiency of a trunking operator during evening and night hours.

A hypothetical example of a telephone system having two exchanges, shows equated calls for the following daily traffic.

Main Exchange 130,000 flat rate calls, 5 per cent trunked	148,200
Main Exchange 3,000 pay station calls, 5 per cent trunked	6,840
Main Exchange 6,500 incoming trunk calls	6,175
Branch Exchange 12,000 flat rate calls, 50 per cent trunked	18,000
Branch Exchange 200 pay station calls, 50 per cent trunked	600
Branch Exchange 800 measured calls, 50 per cent trunked	1,800
Branch Exchange 6,650 incoming trunk calls	6,317
Total equated calls	187,932

Fig. 6 shows an automanual schedule applied to the branch exchange of the western telephone company previously referred to.

The clearing-house principle illustrated in Fig. 2 is applicable to existing systems, with practically no rebuilding except that of the central office switching equipments; the subscribers' instruments and lines, as well as the general method of handling the subscribers, remaining unchanged. The particular feature which renders this possible is the automatic secondary distribution, which brings calls to the operators at one or more centers without the necessity of massing or concentrating talking trunks. This feature is peculiar to the automanual systems, and the economies flowing from its employment may be best illustrated by presenting an extreme case involving the handling of the entire traffic load in a large city, at present divided between two competing systems, both equipped with manual switchboards. The two systems may be designated as *A* and *B*, and the following tables are based on an actual study of their traffic conditions in detail. Table 1 shows the number of telephones in operation in each system, the approximate traffic handled by both companies, and the cost of handling the traffic. Table 2 shows the estimated increase in traffic of both companies as well as the additional cost of operating, if manual trunk lines were connected between two systems, permitting a general interchange of calls. Table 3 shows the cost of handling the combined traffic by automanual clearing-house methods exclusively.

TABLE 1.—PRESENT CONDITION.

	System A	System B	Total or Av.
Number of subscribers' lines	18,666	13,219	31,885
Number of subscribers' telephones	42,000	27,000	69,000
Percentage of telephones to lines	2.25	2.05	2.16
Percentage of business telephones	54	51.5	53
Employes traffic department	498	320	818
Employes average monthly salary	$32.50	$31.50	$32.11
Monthly operating expense	$16,185	$10,080	$26,265
Originating calls daily	294,000	216,000	510,000
Originating calls daily per telephone	7	8	15
Percentage originating calls trunked	57	24	43
Cost per thousand originating calls	$1.97	$1.67	$1.84

TABLE 2.—INTERCONNECTION.

	System A	System B	Total or Av.
Increase in calls per telephone	1.9	3.1	2.4
Calls to other company	79,800	83,700	163,500
Increase in percentage of originating calls trunked	9	21.2	14
Additional employees	153	168	321
Increased monthly operating expense	$5,184	$5,292	$10,476
Increase in cost per thousand calls	0.27	0.13	12
Percentage of increase in pay-roll	32 per cent	52 per cent	40 per cent

TABLE 3.—AUTOMANUAL.

The cost of handling the combined traffic of both systems amounting to 673,500 originating calls per day with the Automanual-clearing-house system based on an average operator's monthly salary of $32.00 would amount to twenty-five cents (0.25) per thousand calls, on a monthly operating expense of $5,051.25. *This makes a reduction in the present operating expense of 86 per cent.*

As the detailed circuits are not described herein, I will state that the talking circuit between subscribers when connected is perfectly clear and, in fact, identical with the standard bridged common battery circuit employed in modern manual exchanges.

Efficiency and Economy

By William Dunton Kerr*

I. SERVICE AND AGGREGATE OF INDIVIDUAL OPERATIONS.

IT IS as much a part of the private duty of a telephone company as of its public duty to perform its functions economically and efficiently. Efficiency and economy are demanded by stockholders as well as by the public. Efficiency implies the maximum effective utilization of operations and processes necessarily undertaken. Economy implies the elimination of all unnecessary operations and expenditures consistent with the proper conduct of the business. Economy and efficiency cannot be considered satisfactorily in the abstract. So many factors enter into the production of the service that generalization is more likely than not to be misleading. Incomplete analyses of costs may be more dangerous that none at all.

Comparative Analytical Method.—The conditions under which service is furnished are never exactly alike in two places at the same time; they may change materially from time to time at the same place. Consequently it is desirable to have a defined method for considering the results of operations, a method which will minimize as much as possible the effect of differences in conditions and circumstances and which may readily be adapted to such differences. Practically speaking, efficiency and economy are relative matters; absolute standards are seldom practicable. Consequently they require for their study a method of comparative analysis applicable to as great a variety of situations as possible.

Individual Operating System Service Unit.—The largest operating unit known to the telephone industry is the individual company. The business is so constituted, however, that no two companies necessarily present the same operating features. One company may operate but a single exchange; another may have only a toll system; a third may be engaged in both exchange and toll service. One company may have a dozen exchanges, while another has a hundred. One company may operate in a densely populated community; another may not. These and a great variety of other conditions make comparisons between entire companies of doubtful value in considering the efficiency and economy of operations. Comparisons are sometimes made of the operating ratios of different companies. In many cases, however, these are of little positive value from the standpoint of actual accomplishment. There is seldom any direct connection between the rates charged by the two companies and the expenses may cover operations under a wide variety of circumstances. If, however, the service of a single company be divided into component factors, each representing an entire operating system, such as an exchange system or a long distance system, a basis of comparison is afforded between different operating systems of the same company and systems of different companies. The operating ratio can be used to better advantage in making such comparisons, but still there is the possibility of a wide diversity of conditions which tends to defeat the purpose of the comparisons. It is only when the service of each system is analyzed and resolved into its fundamental

*Part IV. of a paper entitled "Public Relations of Telephone Companies," read at the Fourteenth Annual Convention of the National Independent Telephone Association. Copyright, 1911, by Wm. D. Kerr.

parts that comparisons on a satisfactory basis can be conducted.

Characteristic Operations of Telephone Plant.—Telephone service wherever encountered is made up of a number of characteristic operations. These operations, and the independent but related steps which they comprise, constitute a satisfactory foundation for the consideration of efficiency and economy. These fundamental operations, in the chronological order in which they are performed, may be outlined as follows:

1. Central Office Operations.
2. Wire Plant Operations.
3. Substation Operations.
4. Commercial Operations.
5. General Operations.
6. Depreciation Operations.
7. Tax Operations.
8. Reserve Operations.
9. Profit Operations.

All of the operations involved in the furnishing of telephone service may be grouped in one or another of the foregoing classes. This is true of every telephone system operating under any conditions or variety of conditions. This is a fundamental classification of the operations of a telephone company. It is a proper and a scientific basis for the study of efficiency and economy.

Subdivision of Fundamental Operations.—Each of the fundamental classes enumerated may be subdivided into different groups of operations each having some common characteristic. When the minor operations are so classified, like subordinate groups may be compared for the same system from year to year and for different systems as occasion requires. This process of subdivision of operations may be extended indefinitely according to the wish and disposition of individual managers. In large systems a more detailed analysis might be used than in small systems, but there are always points at which the operations of systems of all sizes and kinds may be on a comparable basis.

Economy and Efficiency Begin at Bottom.—The operations of a telephone company appear, according to the foregoing analysis, to form a sort of pyramid, having a broad basis consisting of a great number of minute, detailed operations. These basic operations are classified according to common characteristics into gradually extending groups until all are embraced finally in one or another of the nine fundamental classes enumerated. These nine classes comprise what is known as the complete service, which forms the apex of the pyramid. Efficiency and economy begin at the bottom of this pyramid and work upward. The completed service is efficiently and economically performed only when each of the basic steps has been efficiently and economically taken. Inefficiency and wastefulness at any one point in the ascending order of operations means a consequent loss of efficiency and economy at the top.

2. STATISTICAL METHOD REQUIRED.

Station Not a Universal Unit.—It is obvious that comparisons between revenue and the cost of the detailed operations can be productive of no beneficial results. Units of measurement are desired which adequately represent the origin of the costs. Such units of measurement must represent identical costs in each operating system, large or small, conducted under any variety of circumstances. It is customary in some comparisons to use the station as a unit of measurement. This is not always satisfactory, however. For instance, the number of stations is not an adequate measure of central office operations in systems of varying degrees of service uses. The extent of central office operations is measured by the use that is made of the facilities of the plant rather than by the number of stations. Stations do not measure adequately wire plant operations. While every circuit must have one station, some circuits have many stations. The station does represent substation operations fairly well, but it bears no necessary relation to any of the other operations.

No Single Unit Adequate.—It is probable that no single unit of measurement can be devised which will afford an adequate measure of all operations. It becomes necessary to adopt suitable units for each group of operations. To the extent that it may be necessary, independent units should be obtained for all the minor groups as well as the fundamental classes. The purpose of central office operations is to enable calls to be handled; a suitable unit for the measurement of central office operations would appear to be the number of calls handled. Some allowance may need to be made for the time or peak load factor entering into central office costs, and for differences between different kinds of calls. The logical unit for the measurement of wire plant operations is the active circuit. The station is a satisfactory unit of measurement for substation operations. The number of individual subscribers may represent commercial operations better than any other unit of measurement. An effective unit for the measurement of general operations is the amount of money expended in the other direct operations. Depreciation, tax, reserve and profit operations may be measured by their relations to plant values and to investments.

Statistical Method Illustrated.—If the statistical methods which have been suggested are employed it will be possible to effect comparisons on the following basis between two or more operating system years, whether of the same or different systems:

1. Cost of central office operations per average call.
2. Cost of wire plant operations per line in service.
3. Cost of substation operations per station in service.
4. Cost of commercial operations per subscriber.
5. Cost of general operations per dollar expended in other direct operations.
6. Cost of depreciation operations per dollar of depreciable plant value.
7. Cost of tax operations per dollar of plant value.
8. Cost of reserve operations per dollar of investment.
9. Cost of profit operations per dollar of investment.

Economy in Construction.—This would appear to be a simple and effective statistical method for the study of efficiency and economy in furnishing service. The same principles may be applied to the study of economy in construction and equipment. The plant naturally divides itself into five classes, as follows: Land, buildings, central office plant and equipment, wire plant and equipment, and substation plant and equipment. The units of measurement heretofore suggested might be applied to these classes.

Cost Data Compiled Regularly.—If a serious effort is made to secure the most efficient and economical results it is imperative that the compilation of cost

data be made a regular feature of the business. There is always a question as to how far a company can afford to go in this direction. Outlay in processes of this kind should not exceed their value to the business. But the statistical method should always be given the benefit of the doubt. Cost data should never be collected because they are interesting. They should have a direct bearing on efficiency and economy. Whatever system may be employed should be made to serve the business; the requirements of the business should not be subordinated to those of the system. The system should be sufficiently flexible to be adapted to new conditions as they arise. An advantage of a comprehensive system of cost analysis from the standpoint of continued efficiency is the protection it affords against the dangers of a too personal management. Men die, and if the knowledge which they have acquired is stored only in their brains it perishes with them. An adequate cost system perpetuates the experience of the years as they pass by and makes the accumulated experience of many years available for all time to come. The individuals charged with the responsibility of telephone properties can leave behind them no more lasting monuments to their genius and success than accurate and useful records of their accomplishments.

Traffic and Service Data Invaluable.—It is hardly necessary to state that the study of traffic and service conditions should be unceasing. The experience of electric utilities in the analysis of service conditions, the amelioration of bad conditions and the development of good conditions, should prove valuable to the telephone industry. Spreading the traffic over more hours of the day, increasing the volume of traffic without adding to the peak load, securing a larger use of the facilities required to accommodate a minimum use —these and other developments from the critical analysis and study of traffic and service conditions may be expected to result in substantial economies, capable of being shared in alike by the public and the companies.

Southwestern Managers Meet

The following program was carried out at the two days' meet of the district and commercial managers of the Southwestern Telephone and Telegraph Company which met in Fort Worth, Texas, May 12 and 13:

Remarks by H. J. Pettengill, president; J. E. Farnsworth and P. K. Baker.

Interdepartment Relations—H. D. McBride, General Superintendent of Traffic.

Duties and Responsibility of a Commercial Manager—H. M. Cox, District manager, Waco, Texas.

Relation Between Manufacturers and Telephone Companies—Paul Joslin, sales manager of Western Electric Company.

Personality as a Commercial Asset—R. D. Lancy, district manager, Wichita Falls, Texas.

The Relation of the Manager to the Telephone Industry from the Plant Standpoint—Louis Rosenberg, assistant engineer.

Proper Methods of Developing Rural Business—R. W. Williams, district manager, Cleburne, Texas.

Telephone Accounting—F. E. Bedlow, auditor.

Sale of Service and How to Develop Business—J. M. Corrol, district manager, Temple, Texas.

Collection Methods.—H. G. Brickhouse, district manager, Fort worth, Texas.

Preparing Directory Copy—G. H. Yetman, Superintendent of Directory Department.

How to Develop Small Exchanges—H. D. Phillips, district manager, Lubbock, Texas.

Cannot Cut Rates for Telephones

It is illegal and unlawful for telephone companies to offer free service for a certain period in order to obtain subscribers is what the State Rail Commission of Pennsylvania, decides.

Certain telephone companies throughout the state have been offering free service to terminate after a certain time. The matter was called to the attention of the commission by the Johnstown Telephone Company of Johnstown and the Petroleum Telephone Company of Oil City, who complained that the Bell Company was offering free service in these territories for the purpose of securing patrons. The commission carefully investigated the charges and finally decided that this practice is "illegal and unlawfully discriminatory." The decision goes into the history of the charges made by the two competing companies against the Bell Company and in full the recommendation is as follows:

"It is hereby declared that the practice of the respondent in giving certain periods of free telephone service in consideration of contracts for a longer period of service at the standard rates, is illegal and unlawfully discriminatory, and it is, therefore, hereby recommended that said practice be forthwith discontinued and abandoned, not only in Johnstown and Oil City, where these complaints originated, but throughout the Commonwealth of Pennsylvania.

Semi-Automatic System in Amsterdam

Consul Frank W. Mahin, Amsterdam, says that a trial of the automatic telephone system was made in Amsterdam, beginning May 1. There was only one central telephone office in the city, but in May another was opened, where a semi-automatic system was tried. The telephone authorities doubt so much the efficiency and practicability of the full-automatic system that they decided to approach it by degrees.

The semi-automatic system must have the intervention of the telephone girl, and is thus described: Instead of a table showing the numbers of the subscribers, as in the old way, a device is provided with five rows of buttons, each row comprising ten buttons, representing the figures from 1 to 10. The first row represents ten thousands, the second thousands, the third hundreds, etc. The glowing of a small incandescant lamp indicates when a subscriber desires connection. The girl asks the number, in the usual way, and then effects the connection by pressing different buttons. For instance, if 13,785 be requested, she presses button one of the ten thousands, three of the thousands, and so on. Instruments in the office then rise and turn, making the connection. The telephone girl seems to do what the subscriber does in the full-automatic system. If the connection is made, the subscriber hears a ringing sound. If the desired line is engaged, he hears a blowing noise. The consul thinks there is no clearly apparent advantage in this system, but it is deemed sufficient by the authorities to test adequately the practicability of the full-automatic system.

Who's Who in the Telephone Game

Facts and Fancies About a Man You Know or Ought to Know

IT DOESN'T matter very much whether you ever heard of Chappaqua before or ever hear of it again, but you must know, this once, that there was such a place; that it was sort of a back-door to New York city and that it was the birthplace of Robert Murray Ferris. What's that? Never hear of Ferris, either? Very well, there are lots of real telephone men in the world and you are young yet. However, it goes to prove that every once in a while you get something new. Chappaqua and Ferris, for instance.

Robert Murray Ferris is the chief engineer of the New York Telephone Company. He has been that since 1907. But they don't get out the band when a chief engineer is installed in the New York Telephone Company. It isn't even similar to the ceremony of a new fire chief or anything like that. You just go home the night before—across to Jersey or over to Brooklyn—and come back the very next day, as usual, but your desk may be on another floor, or something like that, and you may not have to punch the time clock any more. Just possible you can have fifteen or twenty minutes more for luncheon, though there's so much to do that the lunch business can't always be considered. In a pinch, it might be done. But you've got to go some to get the rise, remember that.

He Was Born With the Telephone.

Robert Murray Ferris happened to be born with the telephone, by which is meant, the same year, but he was born in Chappaqua instead of Boston, which must have been in his favor. Of course, he went to school, because there were plenty of schools, and he had the time and inclination. Boys always have time, but too few of them have the inclination. New York boys have less of it to be sure, but they make up for the handicap when they grow older. Bob Ferris was prepared for college at the Riverview Military Academy, Poughkeepsie. He grew tall in the maneuvers and never got shorter in telephone work. From Riverview Academy Ferris went to the Massachusetts Institute of Technology—old Boston Tech—from which he graduated in 1897, at twenty-one, with the degree of Bachelor of Science. With his sheepskin in his hand he acted upon the advice and the suggestion of his favorite prof. and accepted an eleven-fifty job with the New York & New Jersey Telephone Company. The job didn't hurt his dignity, even though the pay was small. He was one of the lankiest, most awkward of the awkward squad, consigned to cable inspection.

Cable inspection is hard work. Your report must mean more than a casual, rubber-necking survey of cables. Ferris found it out right away. He climbed the poles and burrowed into the manholes and explored the yards. He was one of eight young men under a wiry little foreman of the gang.

There were only 14,000 telephones in Ferris' territory at that time and not so much cable was used then as now, but it was a job. Right here it should be noted that Ferris found more in the job than his fellows. Where some of the others saw only lead covered cable, Ferris saw the deteriorating effects of electrolytic corrosion—so he specialized on it. His first work of real significance was a study of this subject for his company. The report showed such mastery that he was transferred to the installation of common battery switchboards. In 1902 he was chosen to adapt fundamental plans for the Brooklyn plant, then undergoing reconstruction contemplating the new era of rapid growth. These plans were so thorough and comprehensive that the immediate attention of the company was riveted upon the author. The plans contemplated an expenditure of something like $6,000,000, which was sufficient cause for a look at the young man who planned with such utter disregard for the total amount. More amazing still, the plans were adopted and religiously followed.

When, in 1902, the Pupin coil was the center of interest on the telephonic stage, Mr. Ferris was one of a group of experts who applied it commercially. He was coming rapidly into his own; working like a horse; studying, developing, broadening. Five years later, when John J. Carty became chief engineer of the A. T. & T., Ferris succeeded him as chief engineer of the New York Telephone Company.

Mr. Ferris has his headquarters in the Havemeyer building. There are one hundred and sixty employees on his staff. All matters relating to the construction of new buildings, central office equipment, or anything else pertaining to engineering must go through his hands. The magnitude of the work may be made to appear more

impressive when you recall that New York is the home of the largest telephone system in the world.

Robert M. Ferris is easy to meet and companionable to the highest degree. His habits, like his thoughts, are practical. The electrical societies are always after him for addresses, and get him only occasionally. That is one reason we hear so little about him. But when he does respond in those rare instances, his opinions are always expressive of higher standards, forceful, aggressive, prophesying an ultimate for telephony, remote from present ideals.

In his brief years, Ferris has passed the stage of being rattled. He is calm under the most trying ordeals. Has time to be agreeable in the pinches. Likes his men, who in turn adore him. If he has any other hobby than hard work, there is no record of it. Something of his logic may be gleaned from an expression that came from him at a recent meeting of the New York Telephone Society when he remarked, "Telephone engineering is a question of the gate receipts and the cost of playing the game." It is evident that his position depends very largely on just that kind of a platform.

Michigan Companies Under Commission

Governor Osborn, of Michigan, affixed his signature to the Giles bill April 24. Under the provisions of the Giles bill all corporations doing a telephone business within the state are required to furnish reasonably adequate service and facilities for the use of their lines by the public. All charges made are required to be reasonable and just and every unjust and unreasonable charge is prohibited and declared to be unlawful and the state railroad commission is vested with power to alter, amend or abolish any rate or charge for service, and may regulate by rules or orders any service or facilities. Rebating and unjust discrimination is also strictly prohibited. The act also requires the various telephone companies to interchange service, and when the bill goes into effect next August a subscriber of one telephone company will be able to convey a message to a party on another line without the inconvenience of going to another booth. However, under the provisions of the act the corporation which is required to perform the switching service is permitted to charge the patron five cents.

Every telephone company will hereafter be required to make, on or before the first day of December of each year upon blanks to be furnished by the railroad commission, a statement of its expenses and income for the preceding fiscal year, amount of stock and other securities issued, used and other information that the commission may require. Inasmuch as the state tax commission experts appraise all telephone property to the minutest detail each year it will be practically impossible for representatives of these corporations to falsify as to the statements filed with the railroad commission.

Wisconsin Commission News

Telephone subscribers in the town of Marshfield, Wis., have filed complaint with the State Railroad Commission against the Wisconsin Telephone Company and J. C. Marsh, who operates a local exchange in that city. The complaint states that subscribers are charged three dollars per year in addition to the regular telephone charges, the additional charge being for the privilege of having long distance connection with the Wisconsin Telephone Company, and which they allege is excessive and a discrimination against the patrons in Marshfield. Patrons of the local exchange not having long distance connections were charged ten cents each time they were called to answer long distance calls, which was also held to be excessive and unreasonable. In considering the complaint the commission makes a careful investigation of the case, which shows that the local exchange is in good financial condition, is earning a fair rate of return upon its investment, and does not stand in need of the extra revenue above mentioned, which is made under a contract between the local exchange and the Wisconsin Telephone Company. While the commission acknowledged the fact that connection with the Wisconsin Telephone Company is of considerable value to the Marshfield exchange and its subscribers, yet it claimed that under the law this value is covered by reasonable compensation for the joint services that arise from such connections, as joint rates are subject to the same rules in this respect as local rates. The commission ordered the Marshfield exchange to discontinue the charge of twenty-five cents per month for toll connections against its subscribers having Bell or Western Electric Company's instruments, also the charge of ten cents for long distance service against subscribers who are not equipped with these instruments.

Hagenah Rate Recommendations in Chicago

Sweeping changes in the rate schedule for Chicago's telephones are recommended in the Hagenah telephone report. In some instances the rates are cut, while on other classes of service they are materially raised. According to the report these raises are not considered as increases in the cost of service, but are regarded as "equalizations."

The rate for private exchange trunk lines, such as are installed in department stores and other establishments where the telephone is used to a great extent, is to be placed on a graded schedule instead of a flat charge of $1 per day per line. Mr. Hagenah reports that in many such cases thousands of incoming and outgoing calls pass over the wires every day and such service shows a heavy loss to the company, for which small users have had to pay. On other trunk lines, however, a greater number of calls is to be allowed for the present rate.

On measured rate service the schedule will be $60 per year for the first 1,200 calls, 3 cents each for the next 2,400 and 2 cents each for any excess.

The rates on two-party telephones in residences and elsewhere, which now call for guarantees of 10 cents and 12½ cents per day, respectively, are found to be excessive, but the reductions in guarantees recommended in the report will not affect the rate per call. The slot machine service rates will remain unchanged. The total of these reductions, it is estimated, will decrease the revenues of the telephone company about $400,000 per year if put into effect.

The Association of Telephone Subscribers of Paris, France, was non-suited in its action for damages against the state for interruption of the telephone service after a fire at one of the central telephone stations. The court held that the state was not responsible for damages caused by the interruption of service.

New Automatic Telephone Equipment

By Charles S. Winston*

CONNECTING CALLING LINE TO SWITCHES.

VARIOUS methods have been employed in automatic systems for connecting the subscribers' lines to the first selectors. The old Strowger plan, which is used in a large number of automatic installations, provides an individual first selector for each line, and it is very doubtful whether any of the other schemes which have been used up to this time are its equal when the cost of maintenance is considered as well as initial cost. Several years ago engineers saw that an individual first selector was more expensive than necessary and various substitutes have been devised. The scheme which up to this time has been most extensively used, is the so-called "Keith Unit" which has been described so frequently that description here would be superfluous.

Another scheme which has been proposed is the "back-selecting" scheme. Two relays, a line and a cut-off, are furnished for each line, and when a call is initiated, the energization of the line relay sets in motion the wipers of a line-finding switch, which travel over bank contacts until they come to contacts which are attached to the calling line, where they stop and thus connect the calling instrument to a first selector.

Another plan which has not yet been used in practice but which has many advantages is to use a small 10 or 15-point line switch for each line. In addition to the switch mechanism, which includes one driving magnet, two or possibly three relays per line are required in order to bring about the necessary circuit changes. With this scheme, when a subscriber removes his telephone from the hook, a line relay will be energized and current will be sent through the driving magnet, which will step forward the switch wipers. When contacts which are attached to an idle first selector are reached, the movement of the wipers will cease and the circuit will be continued from the subscriber's instrument to the selector. As one switch is required for each line, it is possible that, although it is comparatively inexpensive, the cost will be greater than that of either of the two other schemes mentioned, but a slight additional cost is seemingly justifiable in order to make it impossible for trouble in the switch to throw out of service more than one line. With the individual line switch, trouble in the line switch may prevent the associated line from calling, but it can have no effect upon a second line. The circuit of a switch of this type will be shown later in connection with the description of the circuits of a complete two-wire system.

AUTOMATIC SWITCHBOARD.

The automatic switchboards installed previous to the last few years used local battery in each instrument for furnishing talking current while the signaling was accomplished by means of current from a storage battery located at the central office. These systems were "three-wire" systems in which the signaling current returned from the subscriber's station through the earth. As electric car lines and electric lighting plants increased in number, it was found that, as in other branches of telephony, earth potentials caused trouble, thus making it necessary, in extreme cases, to substitute for the earth return an additional wire for each line or a common return wire, which served a number of lines.

The first common battery automatic installations were also three-wire systems, but the trouble due to signaling through ground was so great that it was necessary for engineers to devise means which would enable the signaling to be done over a metallic circuit. A number of plans were proposed, one of which was the use of the "slow-acting" relay. That is, a relay which, when energized by current, will hold its contacts closed for a short period after the circuit through its winding has been broken. The means generally used for accomplishing this result is either to place a copper sleeve over the core of the relay or a large amount of copper at one end of the core. A relay

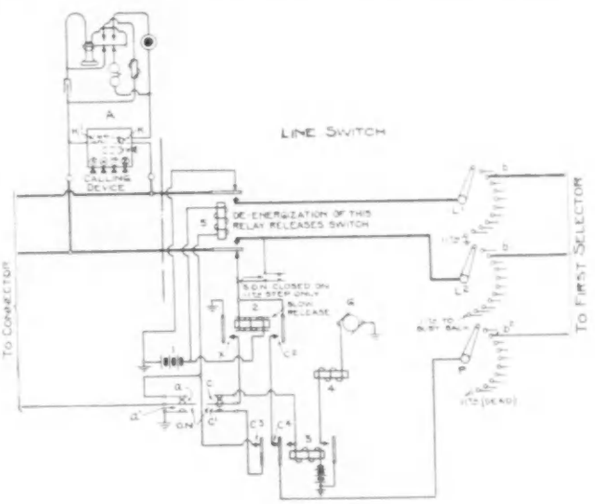


Fig. 7.

built in either of these two ways answers the purpose admirably and by increasing or decreasing the air space between the armature and the pole piece, varying degrees of sluggishness can be obtained.

The circuits of a two-wire system including a subscriber's instrument with a calling device of the "set-up" type, an individual 10-point line switch, first selector, second selector and connector, using the double rotary switch with forward release, are shown in Figs. 7 to 10. It should be borne in mind that it is improbable for various reasons that the circuits shown or the apparatus will be used in practice without changes of a more or less radical nature.

The various steps which take place in establishing a connection between two stations as *A* in Fig. 7 and *B* in Fig. 10 will be as follows:

When the subscriber at station *A* removes his receiver from the hook, he will establish a circuit from the grounded terminal of battery *t* over the metallic circuit of the telephone line, through the winding of

*Abstract of a paper presented at the Pacific Coast meeting of the A. I. E. E., Los Angeles, Cal., April 25-28, 1911. Concluded from the May number.

relay *2* to the negative side of battery *1*. Current flowing in this path will cause the energization of this relay, thus establishing a second circuit through the winding of relay *3*. The energization of the latter will allow alternating current from generator *G* to pass through the winding of driving magnet *4*, thus stepping forward the wipers of the switch, so as to engage contracts of the switch bank. The connections of the off-normal springs *O N* will be changed as soon as the wipers have taken the first step from their normal po-

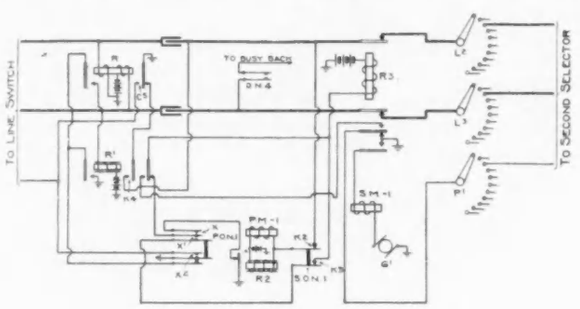


Fig. 8.

sition, and hence contacts *c* and *a* will be broken and *c'* and *a'* closed. It will be seen that as soon as these changes take place the circuit over which relay *3* was energized will be broken at contact *c*, and hence that this relay will then depend for its continued energization upon the condition of the contacts over which the private wiper *P* is passing. The bank contacts of this switch are multipled with the bank contacts of other line switches and are connected to first selectors. When a first selector switch is in use, its private contact will be connected to ground as will be described later. If then, the first private contact is grounded when wiper *P* reaches it, relay *3* will remain energized and the driving magnet will step the wipers ahead until a second contact is reached. If this contact is not connected to ground, relay *3* will fall back to normal, thus breaking the circuit through the driving magnet *4* and the wipers L^1, L^2 and *P* will come to rest upon contacts *b*, b^1, b^2 respectively. When relay *3* becomes de-energized, a circuit will be closed through contact *x* of relay *2*, closed contact *c'* of the off-normal spring, back contact c^3 of relay *3*, and the winding of relay *5*. Current flowing through the winding of relay *5* will cause it to attract its armature, thus opening the circuit which previously existed through the winding of relay *2*. This latter relay would fall back immediately were it not for the fact that it is a slow releasing relay. The instant that relay *5* is energized, relay *R* of the first selector (Fig. 8) will attract its armature, due to current flowing through its two windings and the subscriber's line and instrument in series, thus causing the energization of relay *R'* and connecting ground through contact c^5 to contact b^2 on the line switch, and preventing other line switches from connecting with this first selector. The energization of relays *5* and *R* is accomplished in a small fraction of a second and relay *2*, although the original circuit through its winding was opened by relay *5*, remains energized over a second circuit which extends from battery *1* through its winding, contacts c^2 and c^4 private wiper *P*, bank contact b^2 to ground at the armature of relay *R*.

The calling instrument will then be connected to a first selector, and the subscriber will proceed to set up on his calling device the number of the station desired, for example 5472, and turn the starting lever. Contact *K* will then be opened and closed five times while contact *K'* remains closed, thus preventing the subscriber from receiving a disagreeable click. Each time the circuit is broken and closed in this manner, relay *R* of the first selector will be de-energized and energized and a circuit will be established five times momentarily from ground at the armature of relay *R*, through contact K^4 of relay *R'* contact K^2 of the secondary off-normal, thence through relay R^2 of the horizontal or "primary" magnet, *P M — 1*, in multiple to the negative or non-grounded side of battery. The relay R^2 will attract its armature the instant current flows through its winding, and as it is of the slow-release type, its contacts will remain open during the make and break periods of relay *R*, and the primary magnet *P M — 1* will force the wipers of the switch forward one step, in the horizontal direction, for each current impulse. After the impulses cease relay R^2 will fall back and current will flow from ground through the contact of relay R^2 and the primary off-normal contacts *x* and x^1, (the three springs which form these contacts will be bunched at all times when the switch is out of its normal position) through the secondary off-normal K^2 to the negative side of battery through the winding of relay R^3. The energization of this latter relay will close a path for alternating current from generator *G'* through the winding of the vertical or "secondary" magnet *S M — 1* to ground, thus causing the switch wipers to move vertically and hence to engage the bank contacts. As soon as the switch makes one vertical step, off-normal contacts K^2 and K^3 will open and relay R^3 will depend for its continued energization upon the condition of the contacts over which private wiper P^1 is passing. As soon as this wiper rests upon a contact which is not busy and hence ungrounded, the flow of current through the relay R^3 will cease, thus breaking the circuit through the secondary magnet, and the switch will come to rest. The circuit from the subscriber's instrument will then be continued to a second selector. The falling back of relay R^3 will place a ground upon wiper *P'*, thus rendering the

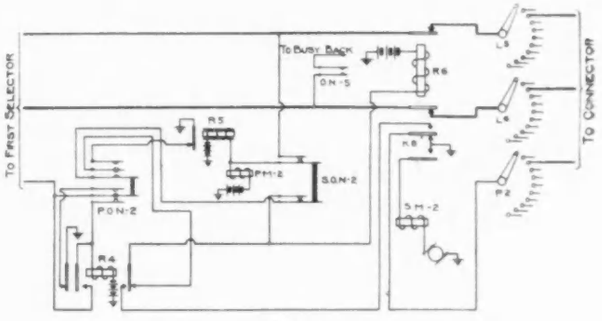


Fig. 9.

second selector busy and preventing other first selectors from being connected with it. This ground connection will also cause the energization of relay R^4 of the second selector.

After these circuit changes have taken place, the subscriber's calling device will break and close the line circuit four times, and again relay *R* of the first selector will be de-energized and energized.. At this time, however, the circuit through the primary magnet *P M — 1* of the first selector will be open at the

secondary off-normal contact K^2, and circuit changes similar to those which took place at the first selector will occur at the second selector (Fig. 9). When relay R^6 of the second selector falls back after an idle contact has been located by the private wiper P^2 the calling line will be connected through the line wipers L^5 and L^6 to the connector, and a ground connection will be placed upon the private wiper P^2 which will render the selected connector busy and establish a circuit through which relay R^7 of the connector will be energized.

When the calling device causes the de-energization and energization of relay R of the first selector for the third time, the primary magnet $P\ M\ —\ 3$ of the connector (Fig. 10) will move the wiper seven steps in a horizontal direction, while the slow-acting relay R^8 will retain its armature in the attracted position. When the impulses cease and relay R^8 is restored to normal, relay R^9 will be energized over the path which begins at ground at the primary off-normal contact $P\ O\ N\ —\ 3$ and extends through contacts K^5 and K^6, the winding of relay R^9 to battery. As soon as relay R^9 is energized, contact K^7 will be closed and K^9 broken and hence this relay will depend for its subsequent energization upon current flowing from ground through contact K^8 of relay R^6 of the second selector. The energization of relay R^9 will cut the primary driving magnet out of circuit and in its stead place the secondary magnet $S\ M\ —\ 3$. This is the condition of affairs which will exist when the last set of impulses, two in number, is sent from the calling subscriber's station. The secondary magnet $S\ M\ —\ 3$ will give the switch wipers their vertical movement while relay R^8 will be energized a second time and locked, while the impulses are being sent, through its own contact K^{12} (contact K^{19} of the secondary off-normal opens with the first vertical step of the wipers) and assume its normal position as soon as the flow of interrupted current ceases.

At this stage of the proceedings one or two things will happen, depending upon whether the called line is busy or not busy. If busy, the private contact upon which wiper P^3 rests will be connected to ground at the off-normal contact $O\ N\ —\ 2$ or at a second connector which is connected to the called line. As a result relay R^{10} will remain inactive and the busy-back signal will be given to the calling subscriber. The circuit over which this signal is given may be traced from ground at the busy-back induction coil I, through contact K^{20} of the secondary off-normal $S\ O\ N\ —\ 3$ contact K^{16} of relay R^{11}, to one side of the talking circuit, thence to ground through one winding of relay R and also over the subscriber's line and through the second winding of relay R. If, on the other hand, the line is not busy when the wiper P^3 reaches its private contact, current will flow from the positive pole of battery at contact K^{17} of relay R^{16} through contact K^9 of relay R^7, contact K^{10} of relay R^8, winding W of relay R^{10} to the private wiper P^3, thence to the private contact of the called line, through the winding of relay 15 to the negative pole of battery. Current flowing over this path will energize relays R^{10} and 15. A circuit which maintains relay R^{10} energized will then be established, through the winding W^1 and contacts K^9 and K^{21}, which will shunt out of circuit winding W and also connect ground to private wiper P^3, thus rendering the called line busy. Relay R^{11} will be energized immediately after R^{10}. When contact K^4 of the latter is closed current will pass intermittently through the winding of relay R^{12} and the interrupter T in series, thus causing the contacts of relay R^{12} to be closed and opened alternately, and connecting ringing current through the wipers L^7 and L^8 to the called line. Each time relay R^{12} is de-energized, the two windings of relay R^{13} will be connected to the line, so that current will pass through them when the circuit is closed by the removal of the called subscriber's receiver.

When, in response to the ringing of the bell, the subscriber answers, relay R^{13} and hence R^{14} and R^{16} will be energized, and the instruments of the calling and called subscribers will then be connected together for conversation. Talking current for the latter will be supplied through the windings of relay R^{13}, while the calling subscriber will receive his supply of current from relay R of the first selector.

When conversation has been finished and the called subscriber hangs up his receiver, he will cause the connector switch to be released and restored to normal, while this same act on the part of the calling subscriber will restore the line switch, the first selector and the second selector. The control of these three switches rests primarily with relay R^1 of the first selector. When relay R is restored to normal R^1 will

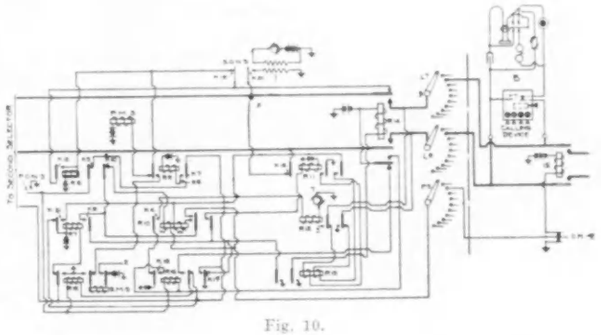


Fig. 10.

also be de-energized, and current will flow through the winding of relay R^3, causing the latter to attract its armature, thus closing a circuit for generator current through the secondary magnet $S\ M\ —\ 1$. The latter will then drive forward the wipers of the switch and when the contacts of off-normal $P\ O\ N\ —\ 1$ are opened, the circuit which has previously existed through R^3 will be opened and the first selector will be in normal position.

When the off-normal contacts $P\ O\ N\ —\ 1$ resume their normal positions contact x^2 of the first selector will be opened and therefore relay 2, and hence relay 5 will return to normal position. The de-energization of the latter will restore the line switch wipers to normal.

When relay R^3 became energized, the circuit from ground over the private P^1 was broken and relay R^4 of the second selector assumed its normal position, thus causing the release of the second selector in a manner very similar to that in which the first selector was restored.

The method by which the disconnection of the connector is accomplished may be briefly described as follows: Relay R^{13} will resume its normal position the instant the circuit is opened at the called subscriber's switchhook. The cut-off relay R^{14} will then be de-energized but relay R^{16} which was energized when the called station responded, will remain in its

energized position due to current flowing from ground at off-normal *P O N — 3* through its winding and normally open contact K^{18} to battery. Therefore, upon the de-energization of relay R^{14}, relay R^{15} will attract its armature, thus allowing alternating current to flow through the secondary magnet *S M — 3* and also placing ground upon the private contact and preventing the connector from being selected during the time of release. As soon as the primary off-normal contact is restored to normal, relay R^{15} will fall back and open the circuit through the secondary magnet. The switch and all relays have then assumed their normal position. If the called subscriber does not respond the control of relay R^{15} and hence the release of the connector switch will remain with the calling subscriber.

If, at the time a subscriber removes his receiver from its hook, each one of the 10 first selectors connected to the line switch is busy, the wipers of the switch will stop upon the eleventh contacts. As the eleventh private contact is dead, relay *3* will fall back and relay *5* will be energized as it will when the wiper *P* rests upon a contact of an idle trunk. However, there is provided on this switch a special off-normal contact *S O N* which is closed only when the wipers are in the eleventh position. In this case, therefore, as soon as relay *5* becomes energized, a path for current through relay *2* is again established over the subscriber's line, through the wiper L^1 to ground at the eleventh contact. A connection from the busy-back induction coil is brought to the contact upon which wiper L^2 rests and hence the subscriber will be notified that he cannot immediately obtain a connection. As soon as he hangs up his receiver, relay *2* and hence relay *5* will be de-energized and the switch will be restored to normal.

The first and second selector switches are each provided with off-normal contacts (*O N — 4* and *O N — 5* respectively) which will cause the busy-back signal to be given to a calling subscriber when the wiper of a switch have made eleven vertical steps, as will be the case when all of the ten trunks in a group are in use.

In nearly, if not in all existing automatic exchanges, battery current is used for driving the selector wipers to select an idle trunk. In some cases a break contact on the driving magnet interrupts the current, and in others an individual interrupter, which serves a number of switches, is used. As already stated, the system described contemplates the use of alternating current. It is the intention to use current of approximately 20 cycles and as a result the wipers will pass over the trunk contacts at the rate of 40 contacts per second. Therefore, in the case of the line switch one-quarter of a second will be required for the wipers to pass over an entire bank of ten contacts, and this speed is so great that there is no danger that the subscriber will operate his calling device before the trunk has been selected.

AUTOMATIC-DISTRIBUTING SWITCHBOARD.

As no automatic-distributing system has been placed in operation, it is interesting only for its future possibilities. A multiple switchboard which is similar in appearance to a manual multiple switchboard will be used. No answering jacks or answering lamps are necessary and upon the keg and plug shelves single plugs will appear instead of pairs of plugs. Switches, which may be of the same general construction as selector switches used in automatic switchboards, are required and at each subscriber's station will be a common battery telephone of the ordinary type, no calling device or additional apparatus being necessary.

In making a call the subscriber will remove his receiver in the regular manner, and by so doing will light a lamp associated with one of the plugs upon the keyshelf at the operator's position. It will be understood that switches similar to any one of the five selector switches already described and either an individual line switch or a back-selecting arrangement can be employed to continue the subscriber's line to the switchboard. The operation of a line relay in the back-selecting scheme will set in motion two separate switches, one will connect its wipers to the terminals of the calling line, while the second will select an idle cord at the first idle operator's position. When both of the switches have come to rest, current flowing through a relay over the subscriber's line will cause the illumination of a lamp on the keyboard in front of an operator. The operator will throw the listening key associated with this lamp and ascertain from the subscriber the number of the station desired. Having received this information, she will, without testing, insert the plug into the multiple jack of the desired line, extinguishing the calling lamp and lighting in its place a second lamp which acts as a supervisory. If the line is not busy, the bell will then be rung automatically until the subscriber responds, when the supervisory lamp will be extinguished. If the line is busy when the connection is established, the subscriber will receive the busy signal and upon hanging up will give the disconnect signal to the operator.

At the end of conversation when the two subscribers have placed their receivers upon their hooks, the supervisory lamps will light and the operator will withdraw the plug from the multiple jacks, thus restoring the switches as well as all other apparatus to normal position.

With this scheme a subscriber's line is not associated with one particular line lamp, as in the case of manual switchboards, but any subscriber may light any calling lamp in front of any operator's position. When a call is made, if no cords are in use, the first idle lamp in the first operator's position will be lighted, while a second call will come in upon the lamp of the next cord in the same position, and so on until all cords at the first position are in use. Additional calls will then automatically pass to the second position. In this way one operator can handle all calls at certain times of the day and when business increases a second operator can take up her duties, then the third and as many as may be necessary. It is not necessary at the time of light load for an operator to change from one position to another or to answer calls in multiple jacks as the automatic apparatus provided makes it unnecessary. It can readily be seen from the facts just stated that inasmuch as the operators work more efficiently than at a manual multiple switchboard, each operator can handle a greater number of calls, thus reducing the total number of operators required, and as a result the total number of switchboard sections. These are the advantages claimed for this system. If it is to be a success, the advantages must be great enough to outweigh the disadvantages due to the use of automatic switches, as well as to the initial cost of the equipment which is considerably more than that of a manual switchboard.

SEMI-AUTOMATIC SWITCHBOARD.

Operators are also required in a semi-automatic switchboard, but instead of using multiple jack equipment as in the automatic distributing, each operator is provided with a desk and apparatus which enables her to receive calls from subscribers, to operate selector and conductor switches and thus establish connections between lines. Either individual line switches or a back-selecting scheme can be used to connect calling lines to the trunk circuits. The method of operation, using the back-selecting scheme, is as follows:

When a receiver is removed from its hook, the operation of the corresponding line relay sets in motion a line selecting switch which selects the calling line, and a second switch which selects the first idle trunk terminating at the position of the first operator having an idle trunk, thus connecting the calling line through these two switching circuits, and lighting a lamp in front of that operator. The operator's desk is equipped with two or more trunk circuits, each requiring a listening key and two, three, four, or five rows of ten keys each for operating the switches—the number of rows depending upon the size of the exchange. That is, if an exchange has an ultimate of 1,000 lines, three rows will be required, while four are necessary for a 10,000 line system and five for a 100,000 line system. When the lamp associated with a group of keys lights, showing that a connection is desired, the operator will, by means of the listening key, place her telephone set in connection with the calling line. After ascertaining from the subscriber the number of the line desired, she will operate the proper key in each of the groups, thus setting up the number of the called line. Immediately after the key corresponding to the first digit is operated, current passing through an interrupter, which is individual to the trunk circuit, will operate the first selector associated with the line selector, and immediately thereafter a second impulse through the key corresponding to the second digit will operate the second selector, and in the case of 10,000 line system, a third and fourth impulse will complete the connection through the connector to the called line. As soon as the last impulse has been sent to the connector, the lamp on the operator's keyboard will be extinguished and the trunk over which the preliminary connection to the operator's desk was made, will be disconnected and placed in condition to receive a second call. The bell of the called station will be rung automatically and at the end of conversation the switches will be disconnected, without the assistance of the operator, when the subscribers hang up their receivers.

It is easily seen that many variations in the method of operation of semi-automatic can be made and that there is a wide field for argument as to the importance of certain features. It will be noted, for example, that in the operation described, the operator is disconnected from the subscriber as soon as the last impulse has been transmitted to the connector. Hence, if the attention of the operator is again desired by the subscriber, for any reason, the operation of the switchhook may place him in communication with a second operator, thus causing possible confusion and dissatisfaction.

It is probable that before many years the differences of opinion which now exist as to the relative advantages of manual and automatic will disappear, and that definite standards will be adopted for the various conditions of practice. It is possible that for localities of a certain size one system will be used, while for larger and smaller installations entirely different systems will be found to meet the requirements more satisfactorily. It is now impossible to foretell what this ultimate solution of the problem will be, and one who is bold enough to attempt to do so is putting his reputation as a prophet to a severe test.

Surgeons Probe by Telephone

Probing with the aid of the telephone is the latest application of electricity to surgery. The process is an improvement over the electric probing for bullets and depends for its efficacy upon several needles instead of one. The telephone searcher or probe is used for hunting for metallic substances in the body which ordinarily might elude the quest of the surgeon on account of their small size. The device is described at length in the *Medical Record* by Dr. William S. Thomas of St. Luke's hospital.

In the search for metallic substances in the body, such as pins and needles, the fine points of the telephone searcher are made to traverse the tissues where the foreign matter is concealed. The general location of the troublesome substance is at first determined by an X-ray photograph.

The probe consists of three parallel needles insulated from one another on a handle, and each is connected with the wire of a three-conductor cord. The conductors are connected with a battery and a telephone receiver in such a way that when metallic contact is made with any two of the three points the operator gets a sound through the receiver clasped to his head. Once the grating is heard the operator turns off the switch in order to prevent heating at the point of contact by the electric current. The searching needles are left in position and the surgeon cuts down to where the foreign substance is indicated and removes it.

Washington's Public Service Commission

The new Public Service Commission in the state of Washington consists of three members appointed by the governor with the consent of the senate, for six-year terms. Each commissioner is to receive a salary of $5,000 a year. A secretary to receive $2,000 a year salary is to be appointed by the commission. Other officers of the commission are to be a rate clerk and statistician at not more than $3,000 a year, an engineer at not more than $3,000 a year, an inspector of safety appliances at not more than $3,000 a year, an expert accountant at not more than $1,800 a year, a stenographer at not more than $1,800 a year, and such engineers, inspectors, accountants and other assistants as the commission may deem necessary. The commission is to have jurisdiction over all public service companies in the state.

The commission is authorized to fix rates, fares or charges, and where rates, fares or charges are insufficient to yield reasonable compensation the commission is empowered to determine the charges and to fix the same by order. It is also given power to fix joint rates and through routes on railroads. Every public service company is to notify the commission of every accident which results in death or injury to any person. The commission is authorized to investigate all accidents and to order repairs or changes in railroad property wherever it deems changes or repairs necessary.

Digest of Foreign Telephone Literature

Translated for Our Readers

TELEMICROPHONOGRAPH.

THE telemicrophonograph, perfected by Ducret, permits sounds from a phonograph, graphophone, etc., to be transmitted long distances to telephone receivers. This apparatus has a microphone, similar to those used on the French warships to transmit commands to the batteries. This microphone can stand high tension currents and can therefore operate upon several telephone receivers on the other ends of the wires.

The microphone is fastened on the phonograph (in this case) and takes up the sound waves proceeding from the magaphone, transforms them into telephone currents, and sends them over the wires into the distance. As the microphone and the membrane at the end of the megaphone are independent of each other, both can easily be regulated, which results in good functioning of the apparatus. The telephone transmitter is also of the Ducret system.

The distance between the vibrating membrane and the pole surface of the electro-magnetic system can be regulated micrometrically. The necessary current can be given either by a primary battery or a few storage battery cells. The voltage of current, and with it the strength of the sounds transmitted is regulated by a small plug switchboard.—*Elek. Anz.*

GERMAN PRACTICE OF AUTOMATIC TELEPHONY.

German automatic telephone exchanges use the "Strowger" system, which is, however, changed in many respects to adapt it to German telephone practice. To get a good idea of this, we take a 100 subscriber system, for example: Each subscriber has at the telephone exchange a so-called selector, through

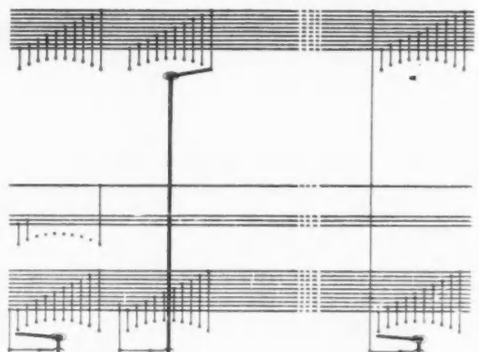


Fig. 1.

which he can connect with any of the 100 connected subscribers. Each of these 100 selectors has 100 contacts, which are fitted in ten semicircular horizontal rows of ten each. Each of these 100 contacts is led through the 100 selectors by a multiple switch system. A contact arm which can move in a vertical as well as a horizontal direction permits the connection to be made. Suppose subscriber No. 1 wishes to call No. 99. One of the line selectors lifts its contact arm ten times, leaving it in front of the ninth row (the lowest one being zero) and turns it then ten times. Then, as Fig. 1 shows, subscriber is connected to No. 99. Fig. 2 shows the wiring and switching system of a 100 group system. In this system only the subscriber's switching apparatus is shown, which permits choice of subscriber's line at the exchange; the other parts, as condensers, switch, etc., are like all other telephones. Suppose a subscriber makes a call. The telephone operator at the exchange gets the number with which the subscriber wants to be connected. Then she puts the connecting plug in front of the jack of the desired party, and tests by contact with same, whether the line is busy or not. If it is open and she hears no sound on contact with jack, she makes connection. If she sees the signal lamp give the sign of "through," she disconnects again. Fig. 2 shows the automatic part of the telephone connections. On the left is the calling disc of the calling subscriber, in the center the switching system, with the corresponding relays, and on the right the group selector. When the subscriber takes off his receiver, a current is closed for the relay *A. B. X.* *A* and *B* become magnetic; but not *X*, because it has a different winding. *B* cuts off line *C* along with the cut-off relay *T* from the positive pole. This makes the calling subscriber's line busy. Suppose No. 56 is to be called. The subscriber turns his disc from "5" on. The *A* and *B* lines are grounded at the station, *X* is excited, because the symmetry of the entire current flow is destroyed (*X* holds *B* excited, so that in case of current interruptions, by the disc, the selector should not be released). *X* closes, moreover, a circuit for the switch magnet *S*. *S* is excited, and its armature attracted. Contacts I and V remain, however, at the present in position 1. At the return run of the disc the *A*-circuit is interrupted five times, consequently is five times without circuit, and consequently five rushes of current are sent from + over armatures of *X*, of *A*, lifting magnets *H*, switch lever IV and — pole. *H* is excited five times, and the shaft is raised five steps. After the subscriber's disc has run back, *X* releases the armature. Now *S* becomes currentless, and switch lever moves from one to two by means of a spring. Then the subscriber turns the disc from "6" on. As before, *A*- and *B*- lines are ground circuited, *X* and *S* are excited. Impulses now travel over rotating magnet *D* instead of over *H*, consequently the contact shaft is turned by six steps. After the disc has finished its run *X* and *S* become currentless. The switch lever moves into position 3, and from here at once into 4, while *S* in position 3, receives an impulse by means of lever from interrupter *U*. As the position 3 is passed, the selected subscriber's line, No. 56, is tested by means of relay *Y* over lever 3 and ground.

If the line is open, the *C*-line of the desired subscriber is connected over disconnecting relay *T*, contact *k* and contact from *B* to the negative pole. *Y* calls up, and short circuits a portion of its own winding with its own contact, after levers have crossed over to 4. This connects the selective line with ground, and closes it for the other subscribers. *Y* remains in lever

position 4 through *C*, lever III, contact left arm of the three part armature of *Y*, low winding *Y*, + excited.

Now a new impulse comes from the switch magnet *S* over lever V, so that the levers move from position 4 to 5. In position 5, *S* receives another impulse from the interrupter *U*, so that the levers travel to 6. When passing position 5, the levers I and II connect the selected line to the call current source, so that the subscriber receives a call signal. Before this, in posi-

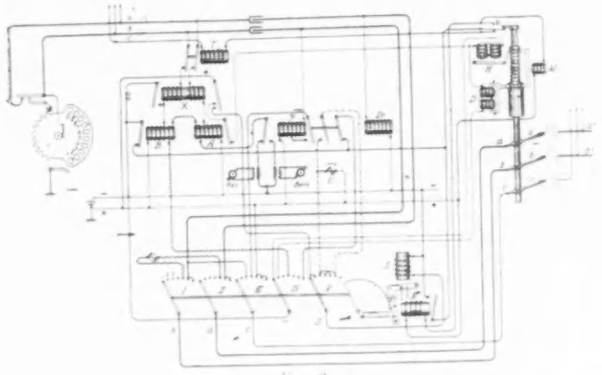


Fig. 2.

tion 4, the calling subscriber has received an "open" signal, since the left armature of *Y* closed a spool induced by a "Sumner" signal, through IV, 4. In position 6 (waiting position) a bridge formed by *Y* and choking coil *Dr* is connected to the desired line. When the called party lifts his receiver, circuit is closed for *Y*. *Y* closes a new impulse for *S*, whereupon the levers move into final position 7. The bridge remains still in the circuit. Likewise the *C*-branch of the called line over lever III remains connected with ground, for position of cutting off the line.

Disconnecting lines: When one of two subscribers hangs up the receiver the line selector is released; when the calling subscriber hangs up, relays *A* and *B* become currentless. *B* closes circuit. *M* (respectively *N*) contact *K*, contacts from *B* — pole.

If the called subscriber hangs up first, *Y* becomes currentless, and following circuit is closed for releasing magnet: *M* (respectively *N*) contact *k*, contact from *Y*, lever IV (in position 7) — pole. *M* and *N* call; *M* releases switch shaft, *N* switch. *N* upholds with its contact the disconnecting current, till upper contact *k* opens. Then *M* and *N* become currentless.

If, however, the line was busy at testing, then *Y* in testing of lever III in position 3 does not call, and the lever III in position 4 is without current. The switch remains in position 4, and the caller receives the "busy wire" signal, as *Y* is not excited.—*Elek. Zeit.*

THE TELEPHONE RELAY.

Numerous tests have been made in recent years in telephone practice to strengthen the sound transmitted by the wires. In spite of numerous patents and trials it has not been found possible to fulfill all conditions necessary in practical work for the desired ends. The two reasons which account for the failure in this direction are probably, first, that the fundamental tones of the relays were chosen too low, and second, that the relays were not sensitive enough. Even the receivers, as also the microphone diaphragms, are deeper in tone than they really should be for best results. If the two parts of the apparatus are joined together in practice, the fundamentals are lowered still more, and the relay therefore strengthens the low tones, but weakens the higher ones, which are the ones that are absolutely necessary to the transmission of sound. Consequently the sound transmitted is in poor condition and unintelligible.

Another circumstance which impeded the exploitation of the telephone relay was the fact that it was only to be used to strengthen weak currents, and therefore it was only brought into the line at the ends of the electric current circuits. In long overhead lines, as, for example, in 1,000-km. lines, the stray currents are almost as strong as the telephone currents, and it can even happen that the stray currents have a higher tension than the telephone currents. As the frequency of these currents will always be lower than the telephone circuit frequency, the result is that the stronger currents are strengthened still more, resulting in a poor transmission of sound. To be successful the telephone relay must be placed in the circuit where the telephone currents are far superior to stray currents, which is done in most cases in present practice on long distance lines. It is probably impossible to construct a telephone relay which will meet all the requirements of the present type of microphones. However, it is possible with high tension microphones, even without relay, to speak over lines of several thousand kilometers length. If a telephone relay is placed in the circuit after the first 1,000 km. the effect can be improved considerably.

If, for example, the vowel "a" is spoken into the microphone, using a 1,300-km. line of 4 mm. bronze wire, and the relay is placed after the first 900 km., the receiving current at the end of the line will be 1,928 microamperes, where it would be only 212 microamperes without the relay.

If the same vowel is spoken into a microphone on a 1,700-km. line, and the relay placed again 900 km. from the transmitting microphone, the receiving current will be 848 microamperes, where it would have been 212 microamperes without the relay.

If under the same conditions the distance is 2,100 km. and the relay at 900 km. from the transmitter, the end current without the relay will be 50, with the relay 318 micro amperes.

On a 2100-km. line under similar circumstances, the end current will be 318 microamperes, and when the relay is placed at a distance of 900 km. from the transmitting microphone it will be 7,845 microamperes. Just before the current reaches the relay it will be 1,060 microamperes. If the same vowel is spoken into the microphone of a 2,100-km. line, and a shunt is used, the relay will send a current of 7,000 microamperes into the line. The current just before the relay is 848 microamperes. The current at the beginning of the line is 1,225 microamperes.

Thousands of kilometres can be gained by a single relay placed at the right position in the circuit. In connection with these investigations microphones were used that could be cooled and had a construction similar to that of the ordinary long distance telephone microphones. A receiving apparatus with a lever resistance was also tried, and, of course, in this case the end current is larger. Further tests, in which the relation of the current received in the transmitter and that sent by the relay into the line was investigated, have shown that with a certain number of sound waves resonance sets in, which is also the case in

microphone diaphragm. The best plan was thought to be the one of placing several relays in a telephone circuit, where one relay is calibrated to the number of vibrations most necessary to telephone conversation, namely, the vowel "a," of 900 periods, and then another relay which is tuned to a much higher number of vibrations. This did not work out in practice as anticipated, and no satisfactory results have been found out so far to meet this condition. There is no doubt, though, that a suitable relay which will meet all requirements will be constructed within a short time.—*Zeit. f. Schwachstromtechnik.*

Indiana Association Convenes

The Indiana Independent Telephone Association, at its annual convention, held at Indianapolis, May 10 and 11, elected officers for the ensuing year, changed its constitution and by-laws, and referred to its executive committee for investigation the subject of a state utilities commission from the standpoint of the telephone business. The officers elected are:

President, Nelson G. Hunter, Wabash; secretary-treasurer, Walter J. Uhl, Logansport; executive committee, Hart Farwell, Terre Haute; J. A. Browne, Winchester; Frank Bohn, Fort Wayne; A. J. Payton, Rockport, and William Fortune, Indianapolis.

All of the men, except Mr. Farwell, were re-elected after having held office during the last year. Mr. Hartwell succeeds Theodore Thorward of South Bend on the executive committee.

Following an address by James Garrard of Vincennes, formerly a member of the legislature, in which Mr. Garrard discussed the state utilities commission idea as applied to the telephone business, there was a general discussion of the question. Members of the association appeared to favor a utilities commission. The matter was left to the executive committee for investigation, and later a motion, offered by Theodore Thorward, that the committee be authorized to consult with members in drafting a public utilities measure to be submitted at the next annual meeting, was adopted.

Mr. Garrard, in his address, declared that a public utilities commission would remedy all the evils that exist in the telephone business in Indiana. A commission, he argued, could regulate the business and pave the way for fair competition. He recommended the valuation of "good will" in determining the valuation of the property of a public service corporation as being fair, but James P. Goodrich of Winchester, in the discussion which followed, disagreed with him, declaring that no law could be framed which would accomplish the thing suggested by Mr. Garrard. Several other members joined in the discussion.

Mr. Thorward offered a motion that a committee of five members be appointed to collect data and prepare a bill, but this idea was abandoned, since Judges M. B. Lairy of Logansport and A. A. Adams of Columbia City, both members of the Indiana appellate court, were named as members of the committee and it was feared they could not serve.

An important change in the by-laws was made to the effect that an independent company which has established toll connections with the Bell telephone system can regain its membership in the association. Formerly the by-laws excluded from the membership all independent companies which established connections with the Bell.

Another change was that which provided that any independent exchange or toll line not in competition with other independent companies in its locality should be eligible to membership, but should lose membership if its property passed into the control of the American Telegraph and Telephone Company. Another change provided for the employment by the executive committee of assistance in carrying on the work of the association only when the necessary money was available.

President Hunter in a short talk advocated the organization by the association of a toll company to controll the independent toll business in this state, but Judge Adams called attention to the fact that the Indiana law prohibited one corporation from owning stock in another.

Mr. Thorward called attention to a reply which the Central Union, he said, was circulating to the alleged charge that the Central Union refused in many cases to connect its toll lines with independent companies. He declared that the Central Union was granting toll connections merely because the independents had forced it to do so and not because it liked to do it. President Hunter spoke briefly regarding the work of the independents of the last year, and his talk was supplemented by an address by William Fortune of Indianapolis. J. C. Kelsey of Chicago spoke briefly. Resolutions offered by C. S. Norton of Indianapolis, expressing confidence in the officers of the association and thanking the press for its treatment of the association, were adopted.

Telephone Number a Business Asset

When a telephone number has been used for a long time in connection with a mercantile business, and is generally known among the patrons, it has a distinct commercial value, and may be regarded as one of the assets of the business, according to the ruling of Circuit Judge Amick in the Winthrop receivership case at St. Joseph, Mo. Over such a number the telephone company has no control. It cannot arbitrarily take the number away and give it to a competing concern.

"Unless," qualified the court, "some elaborate change in its numbering system is contemplated by the telephone company, which would result in subjecting all of its patrons to the same treatment. But if I am in some mercantile business, and have used a certain telephone number for a long time, and in a respectable way, and my patrons know that number and associate it with my business, I don't believe the company can take it away and turn it over to my competitor.

"The fact that there is a clause in the subscriber's contract with the company to the effect that the company retains control of its numbers makes no difference. As a new subscriber, I can't demand of the company any particular number, but if I have used a number for a term of years in my business I come in time to have a proprietary right in it."

An American foreign sales manager writes to the Bureau of Manufactures that one of his correspondents in the Philippine Islands is interested in receiving printed matter and prices on telephone installation. Correspondence should be in Spanish, if possible, and should be sent direct to the inquirer. Refer to file No. 6726.

Recent Telephone Patents

By David S. Hulfish

976,961. Telephone and Telegraph System. H. G. Webster, Chicago, Ill., assignor to Kellogg Switchboard & Supply Company, of same place. An arrangement of circuits for compositing a common battery subscriber's telephone line.

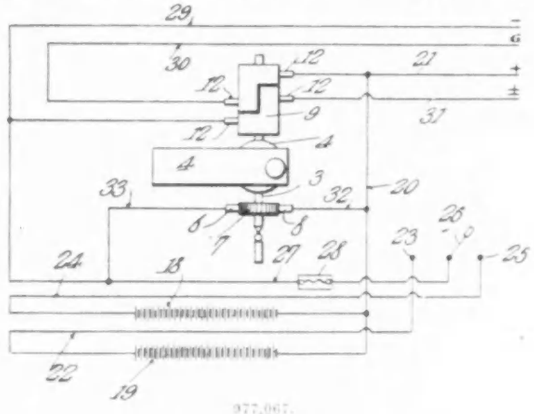
976,962. Wall Telephone Set. A. H. Weiss, Chicago, Ill., assignor to Kellogg Switchboard & Supply Company, of same place. The novelty is found in the hinging of the box to a comparatively flat base and mounting the apparatus on the base, thus making the apparatus easily accessible when the case is opened.

977,067. Pole-Changer. William E. Butler, David City, Neb. A motor drives a pole-changing commutator, transforming a battery potential into ringing potential. A substitute for the vibrating pole-changer for ringing.

977,114. Relay. Ray H. Manson, Elyria, Ohio, assignor to Dean Electric Company, of same place. Details upon the return-pole-piece type of relay.

977,447. Party-Line System. Edward Gould, Spring Valley, Minn., assignor of parts to S. C. Pattridge, W. D. Ingalls, and Fay Viall, of same place. In a magneto party line, a selecting device for ringing a signal, a key for cutting off the line in the idle direction from a busy median station, and an audible signal device for the portion of the line thus cut off, indicating that the line is busy.

977,462. Wireless Telephone. H. G. Matthews, Gloucester, England. The claims of the patent cover a new type of antenna



977,067.

or aerial, having bundles of magnetized steel wires upon an aerial frame.

977,536. Automatic Switch. C. H. North, Cleveland, Ohio, assignor to North Electric Company, of same place. An automatic switch suitable for use in the Automanual telephone system. The claims rest on interchangeability of the structural units.

977,616 to 977,623, inclusive. Transmitters. Felix Gottschalk, New York, N. Y. These eight patents cover variations upon the diaphragm and mouthpiece arrangements of granular-carbon transmitters.

977,658. Desk Stand. William Leaver, Chicago, Ill., assignor to Kellog Switchboard & Supply Company, of same place. The new drawn metal stand of the Kellogg company. The detail of improvement is the attachment of the transmitter to the shaft of the stand.

977,981. Receiver. H. R. Stuart, Wheeling, W. Va. A central diaphragm has operating magnets upon both sides, thereby increasing the power of the magnets to operate the diaphragm.

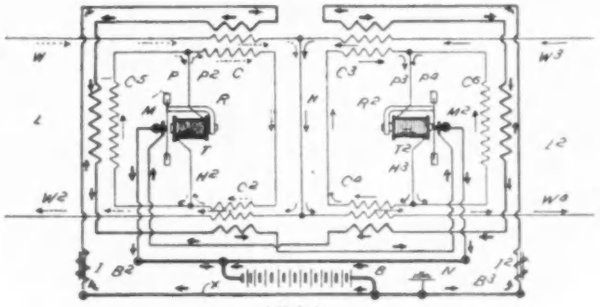
978,070. Transmitter. John Sparks, Kimberly, Cal. The diaphragm controls an air valve which in turn controls the pressure upon the transmitter resistance element.

978,075. Mouthpiece. G. R. Taylor, San Francisco, Cal. The funnel is supported in front of the transmitter front, with an unobstructed space between.

978,083. Repeater. N. G. Warth, Columbus, Ohio. An arrangement of circuits for resistance-and-helix relays, the circuits being shown in an accompanying illustration.

978,370. Attachment. J. G. Harris and A. Mancuso, Philadelphia, Pa. A hinged receiver support clamps around the body of a desk stand, and when the receiver is not in use its extension arm swings across the hook lever and depresses it.

978,603. Reverting Test. D. A. Lawver and C. C. Bradbury, Chicago, Ill., assignors to Kellogg Switchboard & Supply Company, of same place. The reverting call is a call in which



978,083.

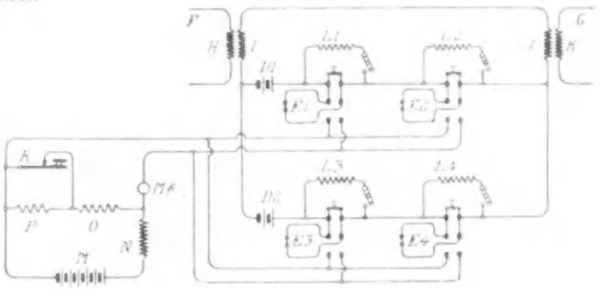
one station of a party line calls for another station upon the same line. Upon a multiple board, the calling plug always finds the line "busy" because of the answering plug. The present patent causes a distinctive tone to be heard when testing, so that the operator is told that the call is a reverting one.

978,774. Coin Device. D. P. Meade, White Post, Va. The novelty is found in the arrangement whereby hanging the receiver upon its hook causes the discharge of a coin from a temporary or interim position in the coin collection box of a telephone set.

978,864. Harmonic Party-Line Telephone Ringer. C. J. Erickson, Chicago, Ill., assignor to First Trust & Savings Bank, Chicago, Ill., trustee. The armature is hung upon the ends of a torsional spring which is anchored in the middle.

978,951. Party-Line System. C. A. Soans and A. H. Graves, Chicago, Ill., assignors to Homer Roberts Telephone Company, of same place. The patent covers improved circuits peculiar to the Homer Roberts system of selection for party lines.

978,958. Desk Set. Burton W. Sweet, Cleveland, Ohio, assignor to Century Telephone Construction Company, Buffalo, N. Y. A desk stand of the tubular type having features of unitary construction for removal of the case and access to the parts.



979,012.

978,992. Relay Magnet. B. G. Dunham, Rochester, N. Y., assignor to American Automatic Telephone Company, of same place. The magnet is of the return-pole-piece type, and has its armature so arranged that it moves in a direction from the core to operate the relay contact springs.

979,012. Repeater. C. D. Lindridge, Providence, R. I. A "negative" resistance element, or one which decreases its resistance when subjected to a current, is used in a local circuit for amplifying the line currents. Means are provided for ad-

justing and substituting these "negative resistances" without interrupting the service of the circuit.

979,467. Attachment. G. W. Gibberd and O. A. Elias, London, England. The transmitter funnel has a perforated portion, outside of which is supported a disinfectant.

979,569 and 979,570. Register. H. K. Sandell, Chicago, Ill., assignor to Herbert S. Mills, of same place. The counter is at the substation telephone set and is worked by the hook, but only the answering of the central office operator permits it to work, so that no count is made if the operator does not answer the call.

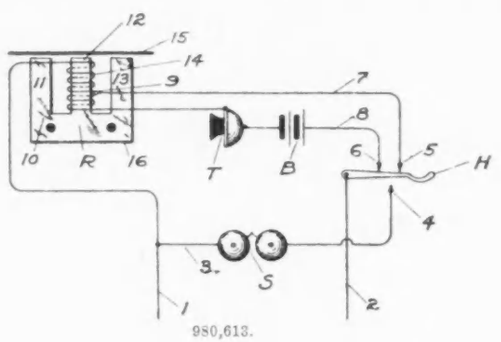
979,590. Private-Line Circuit. S. S. Stolp, Chicago, Ill., assignor to W. J. C. Kenyon, of same place. A metallic line has a grounded battery permanently connected to one wire, and when either telephone is lifted the bell is rung at the other of the two stations.

979,616. Key. Klas Weman, Buffalo, N. Y., assignor to Ericsson Manufacturing Company, Tonawanda, N. Y. A ringing and listening key. The angle plate is attached to the top at the lever pivot, and the switching springs are mounted upon both sides of the angle plate.

979,986. Repeater. Howard Morgan, Quinter, Kan. Two sets of magnets are carried by the frame, each set connected to one of the two repeated circuits, the poles of the magnets being adjacent.

980,024. Receiver. W. H. Thompson, Wheeling, W. Va., and H. R. Stuart, Milwaukee, Wis. In a single receiver are two separate magnets, two separate diaphragms and two separate tubular nipples for two rubber tubes to the two ears of the telephone user.

980,042. Transmitter. Charles Adams-Randall, New York, N. Y. The diaphragm operates a number of electrode-pairs, and



980,613.

connectors are provided for connecting them in series or multiple to vary the resistance and action of the transmitter.

980,153. Hand Generator. Thomas S. Hemenway, Buffalo, N. Y., assignor to Ericsson Manufacturing Company, Tonawanda, N. Y. The claims pertain to the automatic switch operated by the driving shaft when the handle is turned.

980,256. Police System. G. W. Herrick, St. Mary's, Pa. In a telephone exchange, a relay is placed in the line to cause street lamps to burn as a police signal.

980,356-9. Multiple Telephony. George Owen Squier, U. S. Army. These four patents are upon the system recently commented upon very generally by the technical and non-technical papers. At the transmitting end, high frequency oscillations are impressed on the line wires and are modified in accordance with speech; at the receiving end is means for detecting the oscillations, the entire line being tuned to the frequency of the oscillations.

980,417. Automatic Selector. Howard B. Holmes, Park Ridge, Ill., and Edward B. Craft, Chicago, Ill., assignors to Western Electric Company, Chicago, Ill. The contact bank is flat, with the contacts in rows; a brush for each row and means for moving the brushes separately and in mass.

980,465. Attachment. Frank S. Weyrs, Philadelphia, Pa. A support for the entire telephone set, for desk convenience.

980,613. Receiver. W. W. Dean, Elyria, Ohio, assignor to Dean Electric Company, of same place. The receiver is without a permanent magnet. The winding is in two parts, one of which is in circuit with the transmitter battery, both parts together constituting the induction coil of the telephone set as well as the receiver.

980,619. Hook lock. W. R. Ewing, Mars, Pa., and C. P. Ewing, Renfrew, Pa. The hook lever is locked until the generator crank is turned, thus preventing lifting the receiver from the hook except by ringing upon the line.

980,690. Coin Device. H. R. C. Spencer, Granville, N. Y. A number of coins may be placed in the coin chutes in payment for a message, and the operator subsequently may pass them all into the receiving till.

980,857. Party-Line System. Clarence A. Anderson, Salina, Kan., assignor to the Anderson Electric & Manufacturing Company, Wichita, Kan. A party-line system for exchanges, working with common battery speech transmission. A stepping selector is used at each telephone, and lockout features also are provided.

980,883. Automatic Calling Device. N. E. Norstrom, Chicago, Ill., assignor to Anderson Electric & Manufacturing Company, Wichita, Kan. A signal transmitter for automatic telephone exchanges or party-line telephones, for selecting a desired station.

980,884. Arrestor. N. E. Norstrom, Chicago, Ill., assignor to Anderson Electric & Manufacturing Company, Wichita, Kan. Two carbon blocks for the two line wires have between them a grounded carbon block movably mounted.

980,885. Cable Box. N. E. Norstrom, Chicago, Ill., assignor to Anderson Electric & Manufacturing Company, Wichita, Kan. A magnet is provided for agitating the carbon blocks of a cable box, for the purpose of clearing them.

980,886. Signaling System. S. A. Norstrom, Chicago, Ill., assignor to Anderson Electric & Manufatcuring Company, Wichita, Kan. A system of signaling from the central office for operating stepping devices at telephone stations for calling.

Engineers Hear About San Francisco

At a joint meeting of the electrical section of the Western Society of Engineers and the Chicago section of the American Institute of Electrical Engineers, May 24, S. G. McMeen gave some "Notes on a Telephone System Recently Built in San Francisco and its Neighborhood." San Francisco's automatic system serves a population of over 600,000, including Oakland and Berkeley. The initial expenditure was $4,000,000. The large area of underground distribution, the nature of the various soils encountered in this underground work, and the time limit placed on the construction were some of the unusual conditions met by the engineers in charge.

Those who read Mr. McMeen's description of the San Francisco system in TELEPHONE ENGINEER for August, 1909, will remember the many interesting points about the installation, to which the speaker added a number of the more popular features, as, for example, the reminders of the days of '49 which were excavated during the laying of the conduits.

Direct-Call Long Distance Service

May 1 the New York Telephone Company put into effect a new system of handling calls between New York and Philadelphia. Under the new arrangement anyone in New York wishing to call a Philadelphia subscriber can give the Philadelphia number to the New York operator, remaining at the telephone until the connection is completed.

This is the so-called "Two-number service"—that is, the calling party pays the toll charge on getting the number called, whether the particular person wanted is obtained or not. For this service the toll rate is reduced to 65 cents, the regular "particular person" rate between New York and Philadelphia being 75 cents.

The Law and the Telephone

By E. J. Wenner

NEW DEVELOPMENTS IN NATIONAL TELEPHONE COMPANY TANGLE.

THE Metropolitan Trust Company of New York has petitioned the Federal court at Clarksburg, West Virginia, to transfer the stocks of the underlying companies of the National Telephone Company to it; and have asked permission to intervene as a party in the suit of Howard against the National Telephone Company.

It will be remembered that we have mentioned the affairs of the National Telephone Company in several previous issues.

TELEPHONE COMPANY ENJOINED FROM BUILDING LINE ON A SIDE OF A HIGHWAY OCCUPIED BY ANOTHER COMPANY—INTERFERENCE WITH WIRES—RIGHT OF OCCUPANT.

The Kinloch Long Distance Telephone Company has secured a temporary injunction from the circuit court of Missouri, restraining the Missouri and Kansas Telephone Company (Bell) from erecting a certain proposed pole line on the east side of the public highway leading north from Central avenue in Joplin for a distance of two miles.

The plaintiff alleges that it has a pole line on the east side of said road, and that defendant has begun the erection of a line directly underneath the plaintiff's wires in such a way as to obstruct plaintiff's rights and make it impossible to place additional and lower cross arms on the plaintiff's poles.

Plaintiff also claims that defendant has been blasting holes along this route, and that the blasting has interfered with the wires of plaintiff and has permanently damaged them. Plaintff alleges that there would be constant interference between the lines of the two companies if built in such close proximity.

This case considers an important question and one that has been raised on many occasions. It is expected the court will decide how close to the wires of another a telephone company can build its wires without interfering with the property rights of the other company.

FEES ON ACCOUNT OF TELEPHONE LITIGATION—ATTORNEYS RECOVER IN SUIT.

King and Boggess, attorneys at law, have recently won a case in the appellate court at Peoria, Ill., in which an action was brought against W. A. Gray for fees arising out of the sale of a telephone company over two years ago. The attorneys handled the matter for gray and asked fees in the sum of $1,091.80. Gray refused to pay them and they brought suit in the circuit court, where they obtained a verdict. Upon appeal the judgment of the lower court was affirmed.

WILL NOT USE TELEPHONES.

Because of the suit pending against the Central Union Telephone Company the mayor and commissions of Moline, Ill., have concluded to do without telephones in their offices. The parties mentioned take the position that if they ordered telephones installed in their offices it might be considered a recognition of the company's right to operate in the city.

INITIATIVE ORDINANCE DECLARED INVALID—PROSECUTIONS DISMISSED.

The court of criminal appeals of Dallas, Tex., declared invalid the so-called initiative ordinance relating to telephone rate regulations.

Prior to the decisions of the court, General Manager Farnsworth of the Southwestern Telephone Company and R. W. Ingersoll, local manager of the same company in Dallas, Tex., were arrested on complaints of subscribers arising out of their refusal to obey the ordinance. Since the court has declared the ordinance invalid the forty-seven charges against these two defendants have been dismissed.

SUBSCRIBER DEPRIVED OF LONG DISTANCE SERVICE—SUES FOR HEAVY DAMAGES.

Mrs. R. H. Lusby of Little Rock, Ark., claims to have contracted with the Southwestern Telephone and Telegraph Company in February for local and long distance service over the company's line. She claims, further, that during nineteen days of the period covered by her contract she was deprived of long distance service. She alleges that she was caused much worry and inconvenience, and claims to be entitled to $100 for each day she was so deprived. She has brought suit in the circuit court against the company for $1,900.

FEDERAL COURT HOLDS RATE ORDINANCE OF LOUISVILLE TO BE CONFISCATORY—APPEAL TO BE TAKEN TO U. S. SUPREME COURT—CUMBERLAND TELEPHONE AND TELEGRAPH COMPANY SATISFIED WITH THE DECISION.

In these columns we have discussed the case of the City of Louisville, Ky., against the Cumberland Telephone and Telegraph Company, in which the plaintiff seeks to require the defendant to adopt certain rates fixed by an ordinance of the city of Louisville.

Henry Burnett was named as master and was instructed by the court to make an investigation and a full report as to the earnings of the telephone company.

We expect to secure the opinion of Judge Walter Evans, and make a full report of this decision at a later time. It is interesting to telephone companies, however, to know that Judge Evans found that with the present rates, and after making due allowance for depreciation, the company is making 7 per cent on its investment. This is a holding by a federal judge that a telephone company is entitled to an earning of 7 per cent after due allowance for depreciation.

It is understood that the city of Louisville will appeal the case, and if such be true the United States Supreme Court will have an opportunity to pass upon this all-important question.

TELEPHONE COMPANY WINS IN BOND CONTROVERSY—SUIT BROUGHT BY BONDHOLDERS.

The South Texas Telephone Company, with its general office in Austin and connections and toll lines extending to Houston, San Antonio, Temple, Beaumont, Port Arthur, Orange and Necadoches, entered into a contract with Frank C. Smith and H. E. Hunt-

ington under the terms of which these parties acquired $25,000 of the bonds of the telephone company. The contract provided that the total issue of the bonds of the company should not exceed $150,000, of which amount $50,000 should be used in extensions and additions to the property of the company.

The complainants claim that their contract had been broken by reason of the failure of the company to negotiate its bonds for $50,000 for expending and improving the property. Claimants allege that on account of the breach they were entitled to surrender their bonds and recover their value. The telephone company claimed it had never been able to sell its bonds at a reasonable price and was not obliged to sell them for an unreasonable price.

The district court found for the plaintiff and rendered a judgment cancelling the bonds and awarding the plaintiff a judgment for $43,666. The telephone company appealed to the court of civil appeals, which reversed the judgment of the trial court. The majority of this court decided to remand the case for a new trial, and the minority held that judgment should be rendered in favor of the telephone company. The telephone company sued out a writ of error to the supreme court, and that court held in its favor and decided that there was no right on the part of the plaintiffs to rescind the bonds by reason of the breach of contract on the part of the telephone company. The supreme court decided that complainants had a right of action for damages, but could not rescind the bonds and recover their value with interest.

INJUNCTION TO RESTRAIN CITY FROM DEPRIVING TELEPHONE COMPANY OF THE USE OF ITS STREETS.

The East Tennessee Telephone Company brought suit against the city of Frankfort, Ky., for an injunction to prevent a revocation of its franchise rights to use the streets of the city for telephone purposes. The city took the position that on account of certain acts of the telephone company it could be deprived of the use of the streets.

INJUNCTION RESTRAINING CITY FROM REDUCING TELEPHONE RATES.

The city of Paducah, Ky., passed an ordinance reducing the rates of the East Tennessee Telephone Company. On January 10 Judge Evans granted a temporary restraining order to prevent the city from enforcing the said ordinance. The city failed to appear in the suit in his court, and the judge reserved his decision. He has recently announced it, and he holds in this case the same as in the Louisville case—that the rates were confiscatory, and on that account the injunction should be made permanent.

SUIT FOR FAILURE TO DELIVER MESSAGE.

In Austin, Tex., F. A. Maxwell brought suit against the Western Union Telegraph Company and the Northwest Texas Telephone Company for $155.20. The plaintiff claims that a message was given to the two companies to be delivered to a land agent, and that on account of delay this plaintiff lost the amount he is suing for.

SUIT AGAINST TELEPHONE COMPANY FOR POSSESSION OF REAL ESTATE.

The heirs of Paul Bremond of Houston, Tex., brought suit against the Southwestern Telephone Company, claiming title to a certain tract of land on which the company had located a new sub-stantion.

It appears the real estate in question was at one time sold under execution, and suit is brought by his heirs to test the validity of certain proceedings, and if the heirs are successful in this they will probably start suit involving the title of several millions of dollars' worth of Houston real estate.

DAMAGES ASKED ON ACCOUNT OF DISCRIMINATION.

Adelia P. Danaher brought suit in the circuit court of Little Rock, Ark., claiming $4,000 damages against the Southwest Telephone and Telegraph Company on account of discrimination. Plaintiff alleges the company declined and refused to furnish her service for forty days without proper cause, and that such refusal was a discrimination against her.

DAMAGES ASKED BECAUSE OF REMOVAL OF TELEPHONES.

Hugh Seals brought suit against the Southern Bell Telephone Company in Birmingham, Ala., for $1,000 damages on account of an alleged removal of a telephone for which he had contracted and for which he had paid rental. He claims he was deprived of the use of the telephone and on that account was damaged in the amount above stated.

JUDGMENT REDUCED—NEW TRIAL GIVEN UNLESS PLAINTIFFS ACCEPT REDUCTION.

In the case brought by F. M. Carter against the Cumberland Telephone and Telegraph Company in Jackson, Miss., the plaintiffs were given a judgment for $500 for alleged damages. Upon appeal to the supreme court a decree was entered reversing the judgment of the lower court unless the complainants agreed to accept a remittitur of $250.

INJUNCTION SUIT DISMISSED.

At Marshalltown, Iowa, the Jasper County Telephone Company applied for an injunction against the Murphy Telephone Company, claiming use of poles which did not belong to the latter company. It seems a certain telephone line was sold to an individual party, who in turn made a contract to sell a part of it to the Murphy Telephone Company for their use The plaintiff claimed the individual party, through an oversight, took possession of more poles than had been transferred to him, and that the Murphy Company was using some of these poles. The suit had been settled in a friendly way between the two telephone companies.

Spreading the News

The other families in the building knew that the young man was paying attentions to the eldest daughter, but they could not make out whether there was an engagement. None of them happened to be on a party telephone line with the eldest daughter's family. Nevertheless, the telephone indirectly made the first announcement of the couple's happiness to all the apartment community that were within hearing distance of the common hallway the morning after one of the young man's regular evenings for paying the young woman a visit.

It was the girl's mother who made the announcement, as she ran wildly down the stairs to the flat below and called through the open door:

"Mrs. Cohen! Oh, Mrs. Cohen! Give me half a dollar's worth of nickels. Blanche is engaged!"—*Chicago Daily News.*

DEPARTMENT of RAILWAY TELEPHONES

Possibilities of Railway Telephony

By John A. Kick

THE first train order sent by telegraph was refused by the engineer, as he declared it to be unsafe; yet trains have been dispatched for many years by this method. And now that we have the telephone supplanting the telegraph in train dispatching service, an occasional question is raised as to the safety of the telephone for the work.

There is no reason to doubt the safety of the telephone for dispatching as by the methods used there is less liability of error than by the telegraph.

The transmission on up-to-date dispatch-circuits is so good that an ordinary conversational tone carries the entire length of the line and reaches the dispatcher so clearly and with such volume as to be understood without the straining effort which is experienced on the ordinary telegraph or telephone circuit. Telephone dispatches on such lines as are described above are confident of their ability to do much more work with less tiring effort than they were able to accomplish by the use of the telegraph.

By the discovery of the telephone's adaptability to dispatching, many of the most capable and experienced dispatchers were given a new lease of life in their positions. The telephone is not the nerve destroyer that the telegraph has been and many dispatchers who were on the verge of nervous collapse have grown young again.

For handling messages between way-stations, the telephone is very much superior to the telegraph, as the calling means absolutely no delay and the business can be transmitted with greater speed. One telephone message circuit equipped with selective signaling equipment and a first grade transmission system, will carry as much local way station business as two telegraph circuits in the same service.

By this method of handling business at the main office, skilled telephone operators can be economically assigned to each message circuit, giving better service to the way stations than was possible where one operator had to take care of several Morse circuits.

On some short and unimportant branches one circuit has been used jointly for dispatching and message work. In some cases these branch lines have been cut through over a main line circuit by the use of a repeating coil or other means at the junction point.

Branch lines may be normally connected to the main circuit or normally disconnected and can be switched selectively from the dispatcher's station or switched manually by the attendant at the junction point.

The ringing from the dispatcher's station can be either selective or generator, as almost every circuit has some individual requirements. In arranging for operation it is necessary to go carefully into all the main branch line conditions before deciding on the best method to adopt.

For manual blocking both metallic and grounded telephone circuits are being used, either being superior to the telegraph blocking circuits. The circuits are arranged to be operated locally from station to station, but can be cut through by any station which is not a twenty-four hour blocking station.

In yard service the yardmaster keeps in touch with the entire yard by the use of a system of circuits connecting with the round house, machine shops and other departments over which he may call for or give instructions.

Railway wrecking crews are called by the blowing of the machine shop whistle, by callers visiting the homes of the crew, by telephone service through the city exchanges, and last and best by the installation of a telephone system running from an inde-

Department of Railway Telephones

This department is established as a permanent feature of TELEPHONE ENGINEER. The progress of the art of telephone train dispatching, its technical development, its news, and the elucidation of its mysteries for the non-technical worker will be found each month in these pages. The editors invite the problems and solicit the co-operation of the many readers of TELEPHONE ENGINEER in all parts of the world whose interests lie along these lines.

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pendent switchboard direct to the home of each member of the crew, allowing the operator of this board to start the bells simultaneously and continuing to ring until each has answered, insuring the prompt starting of the wrecking outfit with full crew at all times.

Great transfer sheds, where forces of men transfer freight by trucking from one car to another, are being outfitted with telephone systems. One such system terminals in the general billing office, where a clerk is constantly on the line as a dispatcher, the foreman, freight checkers and others in charge at the platform and sheds are outfitted with breast plate transmitter and head band receiver on a cord and plug. As they go about the platforms they call into the line clerk giving and receiving car numbers and assignments.

For this service the circuit is brought to a jack at intervals of fifty to seventy-five feet, and the jacks so arranged and placed as to be accessible and at the same time protected from injury.

The private branch exchange service in connection with railway operation is quite extensive on the larger systems and is a subject of such importance as to be worthy of considerable study and discussion.

The physical condition of lines contributing to a railway terminal private exchange board is seldom of the best, owing to the necessity of running the lines through territory that is being constantly invaded by general physical changes to the tracks and property adjoining.

Private branch exchange territory, unless underground, is in the district where the young American flies kites and fills the lines with string and fine wire. Nevertheless, the service is usually very good and is being extended at a rapid rate.

The private branch exchange in railway service will be made the subject of a later article, wherein the details of management and maintenance will be considered.

In general telephone practice, where the telephone companies give service to the public, the telephone interests do not care to recommend party lines, while in the railway service long party lines are a necessity and are productive of conditions which require engineering ability and special apparatus to secure satisfactory results.

The telephone manufacturing and electric supply companies have men who work in touch with the railways in developing a line of special apparatus and supplies to meet the demands of this special service, and in general much good has resulted from the association.

Capable telephone engineers, installers and trouble men are securing good positions with the railways, and as the field is one in which many new conditions are met, the opportunities to show exceptional ability are many and the positions should be attractive.

Pere Marquette Extends Dispatching System

The Pere Marquette Railroad is so well pleased with its first telephone train dispatching equipment, which it installed a few months ago, that it has recently placed an order for the apparatus necessary to equip three new circuits.

The Western Electric Company, which furnished the equipment for the original circuit, will supply that for the new circuits. The equipment will consist of ninety-three selectors and the necessary telephones and auxiliary apparatus.

The three circuits will provide telephone train dispatching facilities for 466 miles of track, and they are arranged as follows:

The Grand Rapids division, between Detroit and Wyoming, a distance of 192 miles, equipped for 36 stations.

The Ludington division, between Saginaw and Ludington, a distance of 137 miles, equipped for 29 stations.

The Chicago division, between Parker and Grand Rapids, a distance of 137 miles, equipped for 28 stations.

All three of these are dispatching circuits, and on each No. 9 B. & S. copper wire is used. The train dispatchers are to be located at Detroit, Saginaw and Grand Rapids.

B. & O. Likes Telephone

Newspapers recently printed a statement that the use of the telephone in dispatching trains had been found unsatisfactory by the Baltimore & Ohio and that the telegraph was being substituted. This was so different from the experience of other roads that an inquiry was directed to headquarters and Charles Selden, superintendent of telegraph, denies positively that such a course had been decided upon. "This report," he says, "evidently grew out of a change recently made in the method of dispatching over a portion of the Monongah division of our line in the mining district of West Virginia. Some time ago the Baltimore & Ohio installed the telephone system of dispatching on a section of its line between Grafton and Salem, W. Va., when it was deemed advisable, owing to the volume of traffic, to divide the division between Grafton and Parkersburg into two dispatching districts. Traffic on this section of the line has fallen off, however, to the extent that the dispatching is again being handled at Grafton for the entire division, and the telephone service between Grafton and Salem has been temporarily suspended pending its further extension over this territory. The Baltimore & Ohio recently installed a telephone system of train dispatching covering an entire dispatching district on the Monongah division, where numerous trains are handled, and the system has proven so much more satisfactory than the telegraph as to assure its extension to other sections of the road. In fact, I believe the telephone is certain to be adopted in general rail operation." That view is widely held.

Pennsylvania Extends Telephone Dispatching System

The Pennsylvania Railroad, which is already operating a number of its divisions with Western Electric selectors and telephone equipment, has just placed an order for similar equipment for use on its Bellwood division.

The equipment for this division consists of two complete circuits—one a train dispatching circuit between Bellwood and Fordham, a distance of 65 miles, and the other a 57-mile message circuit between Bellwood and Punxsutawney. In all 42 of the new Western Electric selectors will be used, 21 on each circuit. Dispatchers for both circuits will be located in Bellwood. No. 9 B. & S. copper wire will be used on both circuits.

Recent Developments in Railway Telephony

By Gregory Brown*

DURING the long use of the telegraph by the railroads they have built up an efficient organization for handling trains by this method, and have thoroughly standardized in the method of doing this business. In order to determine the requirements to be met by the telephone, if it is to take the place of the telegraph throughout a railroad division, it will be necessary to examine the methods used and the results obtained by the use of the telegraph.

There are three main classes of service on every division which are performed by the telegraph.

1. Train dispatching.
2. Message service.
3. Block wire service.

The train dispatching circuit, or train wire, as it is generally termed, extends along one division and is used exclusively by the dispatcher located at the division point for issuing orders regarding train movements to, and receiving train reports from, operators along the line. The average length of division is about 130 miles (209 km.), which is divided into a number of sections or blocks, averaging about 20 to 25, there being located at the beginning of each block an operator controlling that block. The length of division and number of operators, however, vary greatly, some divisions being over 250 miles (402 km.) long and having between 50 and 60 operators on the line.

The dispatcher has supreme control of each division, in so far as train movements are concerned, and he handles the business somewhat as follows: Each division has its printed schedule of trains, which contains the time of passing all stations and towers, also time and place of meeting for all regular trains, both passenger and freight. In addition to the regularly scheduled trains there are more or less extra trains to take care of the varying volume of business, and also there are delays which invariably occur, particularly in freight service, due to condition of motive power, time of loading cars, weather, etc.

The above conditions contantly disarrange the schedule and as it is the dispatcher's duty to keep traffic moving with the minimum delay, giving preference to the proper classes of trains, such as mail, passenger and perishable freight, it will be readily understood that he is at all times confronted with a complicated problem, the proper handling of which requires great judgment and foresight.

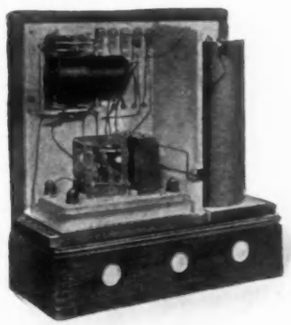


Fig. 1. Gill Selector.

Each of the operators at the block stations has complete control, under the direction of the dispatcher of his block section. It is his duty to report to the dispatcher the time of arrival and departure of trains, and also to transmit a large amount of miscellaneous information concerning the cause of train delays, nature and extent of accidents, hot boxes, broken gears, length of time required to repair, track condition and various other items which are factors that the dispatcher must take into consideration in planning his train movements.

The bulk of the dispatcher's outgoing business consists in giving train orders to one or more of the operators, who, in turn, transmit the orders to the proper train crews. A large proportion of the orders are transmitted simultaneously to several operators. The dispatcher calls the operators interested and when they are all prepared, he transmits the message, and they each in turn repeat it back, in order that the dispatcher may know that his order is properly understood. In addition to the transmission of an order to a group of operators, it will be remembered that the sounders in all the other offices are repeating the same order. This permits every operator on the line, if he so desires, to hear the orders being given and to keep in touch with traffic conditions.

Fig. 2. Gill Selector Ratchet

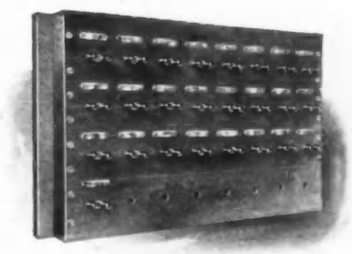


Fig. 3.—Sending Keys.

It will easily be seen that it is of the utmost importance that no interruption occur in train wire service, as the dispatcher's inability to communicate with the operators would practically result in tying up the traffic of the division. In order to provide for interruptions in service which might occur, due to line troubles, it is customary to loop all the telegraph wires on the line through telegraph peg switchboards located in most of the towers. By this arrangement it is possible, should any portion of the train wire get in trouble, for the operators in the affected district to cut out the defective section of wire and connect in its place a portion of any other telegraph line on the division. This, of course, would interrupt the service on the line which was used for patching, but the importance of maintaining the train wire is so great that any other available wire is used for patching until the defective portion of the train wire can be repaired.

The above describes in a general way the manner in which the telegraph is used in train dispatching. We can now specify the requirements which are being met by the telegraph for this service and which the

*Abstract of a paper presented at the Pacific Coast meeting of the A. I. E. E., Los Angeles, Ca., April 25-28, 1911.

telephone must meet in order to successfully compete. These requirements are:

1. Ability to signal any one of 50 or more stations on a 250-mile (402-km.) line and ability to signal dispatcher from any of the stations.

2. Arrangements whereby any number of stations can simultaneously listen in.

3. Means for quickly testing and patching any portion of the circuit which gets into trouble.

In addition to the above requirements, the tele-

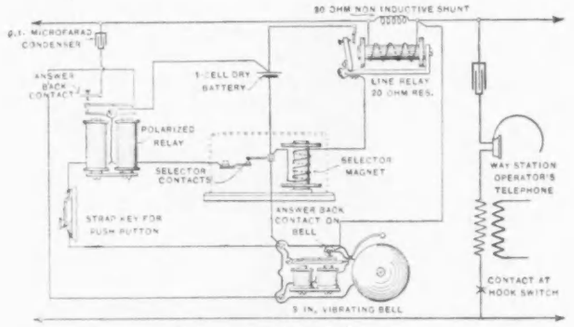


Fig. 4.—Sub-station Circuit.

phone owing to its greater flexibility can be arranged to permit of other operating advantages not possible with the use of the telegraph. Among these are the following:

a. Provision whereby officials who are not telegraph operators, but who are directly interested in

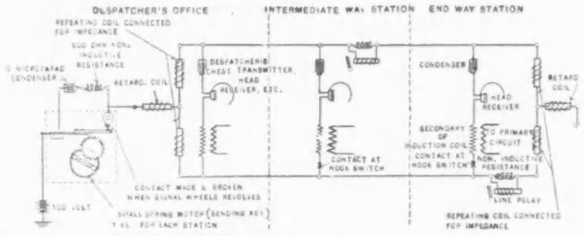


Fig. 5.—Line Circuit.

the movement of traffic, as for instance, train masters, yard masters, division superintendents, etc., can listen on the wire and keep in touch with traffic conditions.

b. Arrangements permitting the signaling of stations without interrupting conversation. This feature results in saving a considerable amount of time.

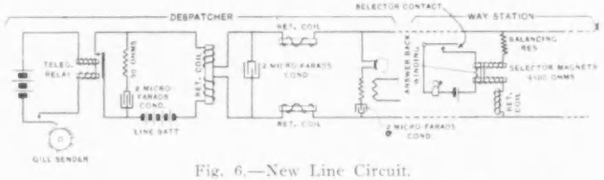


Fig. 6.—New Line Circuit.

c. Automatic notification to the dispatcher that the station he is calling is receiving the signal.

SIGNALING.

The first requirement is the ability to signal any one of 50 or more stations on a 250 mile (402-km.) line.

The problem involved here is selective signaling on a long and very heavily loaded line, and is an extreme condition which has not been met with in commercial practice. When consideration is also given to the degree of reliability required for this service, it will be seen that the development of special apparatus was necessary. The instrument used for this purpose is called a selector and is installed at the substation and so designed that the dispatcher at will can cause any selector to operate, and close a contact, thereby signaling that station by ringing a bell or causing a signal to be displayed. There are three general types of selectors which have been developed for this purpose, operating on three different principles:

1. Instruments responding only to a certain number and sequence of long and short current impulses or long and short intervals between impulses. In this case the only instrument on the line that would function properly and close its contact would be the one which was adjusted to respond to the particular code arrangement of impulses which were being impressed on the line.

2. Instruments arranged to be started simultaneously by the dispatcher and to operate independently

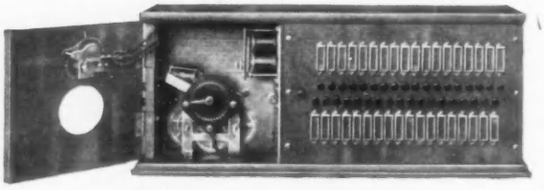


Fig. 7.—Wray-Cummings Despatcher's Keys.

but in synchronism with each other by means of local energy at the station. The dispatcher's sending device being so arranged that at a predetermined instant one impulse is sent out on a line which at this instant is provided with a path through one selector contact only, the other selectors either having passed their contacts or not having reached them.

3. Instruments of the so-called step-by-step type which are stepped around in synchronism by a succes-

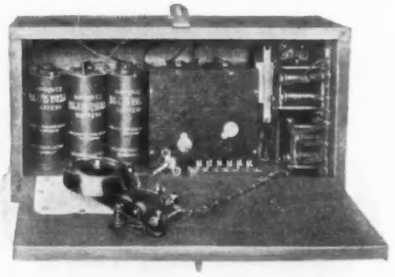


Fig. 8.—Wray-Cummings Selector.

sion of impulses from the dispatcher's office, the number of impulses sent determining the station called.

What is known as the Gill selector is an instrument of the first or code impulse type. This device has been used for a number of years to selectively signal telegraph offices, and for this service it is connected in series with the bank contact of the telegraph relay and battery. When the proper code is sent over the line, the selector will function and ring the bell, but by using ordinary Morse characters it is practically impossible to reproduce the code and falsely call. As this selector had been pretty well tried out for telegraph service, it was but natural that it should be one of the first used with the telephone. Fig. 1 shows a view of this instrument with the glass cover re-

moved. It consists essentially of a ratchet wheel, an electromagnet whose armature is arranged to step the wheel forward, a retaining pawl to retain the teeth stepped and a mechanical time element whose function it is to permit the retaining pawl to assume either one of two positions, according to the length of the impulse of current.*

Fig. 3 shows a dispatcher's sending key cabinet with the cover removed. There is a key for each selector and each key consists of a train of gears, whose speed of rotation is controlled by an escapement, and when operated a specially cut code wheel makes one revolution, sending out on the line a certain code of impulses.

Fig. 4 shows a schematic diagram of the first type of way-station circuit that was used with this selector. The closure of the contact of the line relay puts local battery current through the selector and steps it around. When the selector contact is made, local current flows through the right-hand spool of the polarized relay closing its contacts and ringing the vibrating bell.

The lower relay contact closes the battery through the bell while the upper contact places a

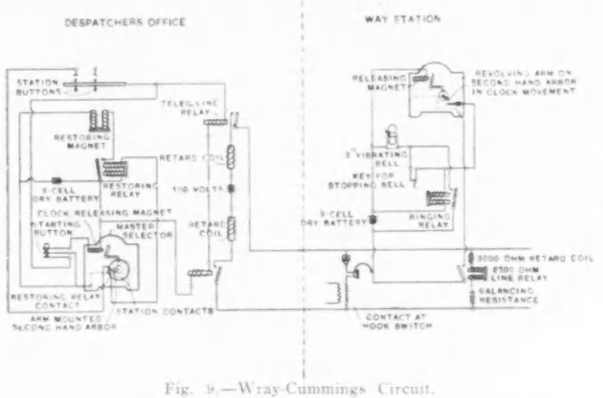


Fig. 9.—Wray-Cummings Circuit.

shunt on one side of the line around the line relay and through a one-tenth microfarad condenser and vibrating bell contact. This shunt through the vibrating contact introduces a tone on the line and is heard in the dispatcher's receiver, thus notifying him that the station bell is being rung.

In the first installations of this type of apparatus the line circuit arrangement was as shown in Fig. 5. It was thought advisable to use a line relay at every station and operate the selectors and bells by local battery. In order that the sending impulses might not introduce enough noise in the receiver bridges to interfere with conversation while the dispatcher was signaling and also to permit each line relay to receive the same amount of current, a grounded simplexing arrangement was used for signaling, the relays being placed in series with the line. Relays at alternate stations were connected in opposite sides of the line, so as to maintain the balance as nearly as possible. With ordinary relays placed in series, the transmission loss would, of course, be very considerable. The relays used therefore on the first installations were of a sensitive type having an inductive winding of 20 ohms and a non-inductive shunt of 30 ohms. This was, in fact, a type of telephone supervisory relay, and from a transmission standpoint was the most efficient relay available. Although the transmission loss in the relay was reduced to a minimum, it was still appreciable especially on a long line with many stations and several receivers off the hook. In addition to this, the shunt winding of the relay made a very inefficient arrangement for operation, as, of course, the signaling current going through the non-inductive shunt represented a clear waste. Another objection to this circuit that was found in practice was noise introduced from the grounds and unbalance, as it is almost impossible to balance the line with series relays. Also the

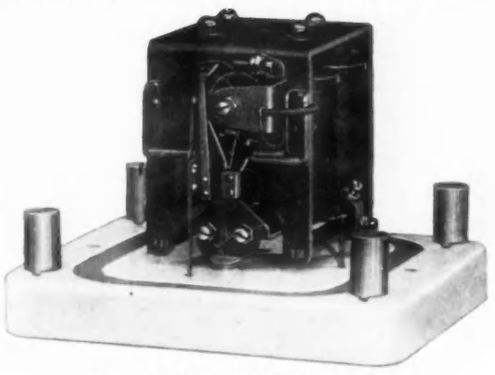


Fig. 10.—Western Electric Selector.

effect of lightning on the series arrangement was found to be rather disastrous. The troubles experienced with this circuit finally led to the development of a new circuit, as shown in Fig. 6. In this arrangement there are no grounds on the line and no line relays used. The selectors are wound to 4,500 ohms resistance and placed directly across the line. If series with the selectors is placed the proper amount of tapering resistance, so that the amount of signaling current through each bridge will be the same.

The answer back is obtained by including, in series with the selector contact bell and battery, a secondary winding on the spools of the selector. As

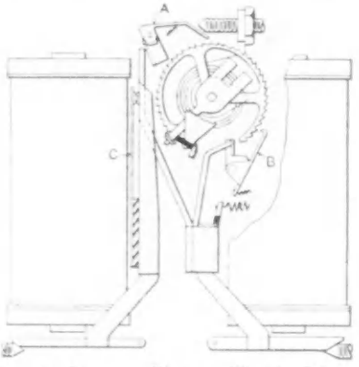


Fig. 11.—Diagram, Western Electric Selector.

the bell vibrates it induces current in the selector windings which produces a tone in the dispatcher's receiver. With this circuit arrangement the normal current for the operation of the selectors is ten milliamperes. The current, however, can fall considerably below this without affecting the operation of the selectors. The retardation coils and condensers at the despatcher's end of the line and used to cut down the peak of the current wave to such a point that the noise in the receivers while the signal is being sent is not enough to interfere with conversation. In this

*TELEPHONE ENGINEER, April, 1910, page 179.

circuit it is necessary to introduce a condenser in series with the receivers across the line in order that the signaling current may not be shunted through the talking bridges.

The second type of selector which has been extensively used, that is, selectors maintained in synchronism by local energy at the substation, is what is

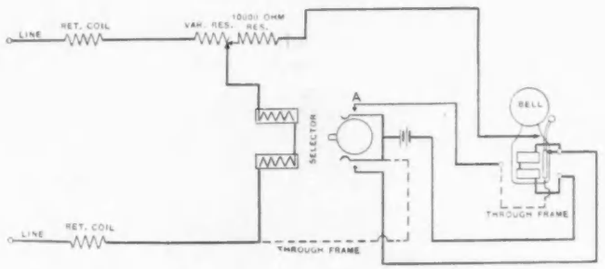


Fig. 12.—W. E. Substation Circuit (Local Battery).

known as the Wray-Cummings selector. Fig. 7 shows the dispatcher's master's sending outfit and Fig 8 shows the substation selector.*

Fig. 9 shows the circuit arrangement at the dispatcher's office and at the way-station.

The third class, or step-by-step selector, is represented in Fig. 10, which shows the Western Electric selector. This device consists of two electromagnets connected in series and mounted in a brass frame. Each magnet is equipped with two spools, the cores of one of the magnets being covered with copper sleeves to produce slow action. Fig. 11 shows the schematic diagram of the lever movements.†

Fig. 12 shows the local battery way-station circuit used with this selector. There are two 40-ohm retardation coils placed on either side of the selector as a protection against lightning. The selector is wound to 3,750 ohms and is connected with the proper taper resistance to produce equal current in all the bridges. When a station is called, contact *A* is made, which closes the local battery through the vibrating bell. The bell is also equipped with a front contact which makes and breaks a 10,000-ohm resistance across the line and gives the despatcher an answer back.

This selector is also arranged to ring a bell by means of the battery located at the dispatcher's office,

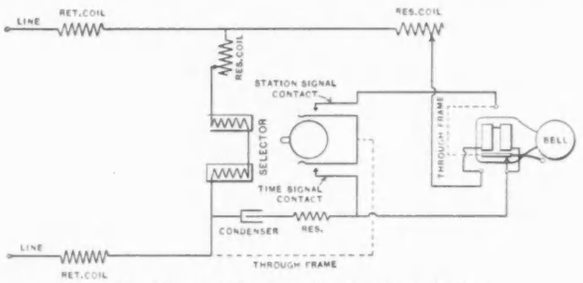


Fig. 13.—W. E. Substation Circuit (Central Ring).

thus eliminating the local battery at the substation. Fig. 13. shows the apparatus so arranged. When using central battery to ring the bell it is necessary, of course, to have it high wound. In this case, its resistance is 1,100 ohms and a taper resistance is used in series to produce the same current through the bell wherever it may be located on the line. It was found that if the taper resistance used for the selector was also used for the bell, the drop in voltage due to the combined current passing through the resistance was great enough to reduce the current to an objectionable extent. Separate taper resistances are, therefore, used on the bell circuit. Fig. 14 shows the dispatcher's sending key, one being used for each station. These keys are mounted by means of a latch in a suitable cabinet and can be individually and quickly removed without disturbing electrical connections. They consist of a train of gears whose speed is controlled by an improved silent governor. The contact wheels are the same in all keys of a given type, but are adjusted for each station by moving the segments so as to uncover the proper number of teeth for the station desired.

This feature makes the keys universal and as the selectors are easily adjustable to any station, they are also universal, and a spare selector and key kept on hand can be arranged quickly to replace any selector or key which may become defective.

Fig. 14.—W. E. Sending Key.

Fig. 15 shows the dispatcher's and line circuit. The contacts of the sending keys are all arranged in parrallel so that the operation of any one will cause the sending relay to operate and place main battery current on the line. Capacity and resistance are placed round the contacts to reduce the sparking. The noise of sending is reduced by leading the battery current through three retardation coils and placing six-microfarad condensers across the line. It was found that if on a dispatching wire the line should from any cause break, leaving but few selectors on the line, the current through the selector bridges would rise to such a point, due to the fact that the total voltage was still used, that the selector stepping armature would stay in its forward position when stepping impulses were sent on the line instead of oscillating and stepping the wheel. This was a serious objection as, in case of an accident of this kind, the dispatcher would be unable to call the stations between him and the break. It was found that this sticking occurred more or less in all types of selector operated by impulse from the dispatcher's office. The fault was overcome to a certain extent with the Western Electric selector by designing the magnetic circuit of the

*TELEPHONE ENGINEER, March, 1910, page 137.
†TELEPHONE ENGINEER, July, 1910, page 37.

selector so that under normal current would be fairly near saturation, excessive current not increasing the pull of the armature very much. This remedied the objection somewhat, but upon further investigation it was found that with excessive current going to the line, the six-microfarad condensers, used for quieting the circuit at the despatcher's office, becoming more highly charged under this extreme condition, tended to hold the selectors up during intervals between

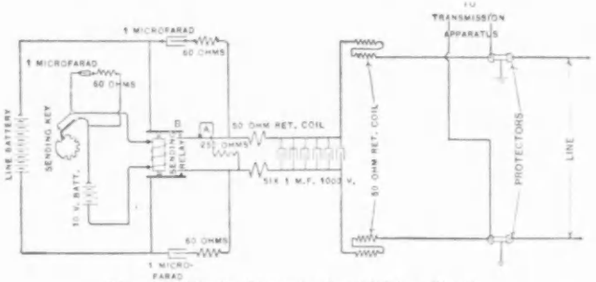


Fig. 15.—W. E. Dispatcher's and Line Circuit.

stepping, due to their discharge over the line and through the bridges. In order to counteract this effect, the sending relay was equipped with an extra contact *A* so constructed that the closurse of the battery contact *B* caused the opening of *A*, and the instant that contact *B* broke, contact *A* made. In series with contact *A* across the line was placed a 250-ohm resistance. This arrangement provides a comparatively low resistance path for the discharge of the condensers and prevents their discharging to any great extent throughout the line and holding the selectors up.

In addition to the three types of selectors described, there are polarized types of selectors which I believe have been used to a small extent. This type of selector generally employs current of one polarity for stepping and of the opposite polarity for ringing. The objection which has been brought forth against polarized apparatus has been that it is necessary to maintain the line poled in one direction all the time, as a reversal of the line wires will cause all the selectors beyond this point to fail. The liability of reversing lines due to line repairs, patching, etc., seems to raise an objection to polarized apparatus.

The foregoing description covers in general the means used by the dispatcher for signaling the various stations. The tower operator, when he wants to communicate with the dispatcher, listens in to learn whether the line is busy, and if it is not, he merely says "dispatcher" in the transmitter. The dispatcher wears a head receiver and central office type of chest transmitter and is on the line all the time.

As we will have to refer to transmission values it might be well at this point to explain the units used.

(To be concluded.)

A Study of Telegraphic Transmission

By Frank F. Fowle*

WHENEVER a wire of high resistance is substituted for one of low resistance, there will be necessarily an increase in voltage of supply to maintain the line current at its former values. This applies more particularly to the substitution of copper-clad for copper, than for iron, because the conductivity of No. 9 copper is much greater than that of No. 8 iron or No. 9 to No. 12 copper-clad. The increased voltage of supply will increase to some extent the cost of operating the line of higher resistance and will thereby affect the comparative economy.

The cost of current supply is much greater from gravity batteries than it is from a well designed power plant. The cost of gravity batteries, including all capital and operating charges, is composed principally of the cost of renewals. The frequency of renewals is closely proportional to the battery output. The average cost of battery maintenance, per cell per annum, is from $1.00 to $1.15; on a basis of 3 lines per battery, the charges are from $.33 to $.38 per cell, per line, per annum. A cell in main line service, feeding three lines, will last about eight weeks; and, correspondingly, if it fed only one line, would last 24 weeks. The zinc element can be used until it wholly dissolves; the copper element appreciates in weight and value, and hence represents a credit. The net cost of two renewals per annum has been estimated at about $.50 per cell.

The number of cells necessary to operate any line is given by the formula.

$$n = \frac{I\ (lr + r_a'')}{e - r_a' I} \qquad (105)$$

Where l = line length in miles.
r = line resistance in ohms per mile.
I = line current in amperes.
e = battery E. M. F. in volts per cell.
r_a' = internal battery resistance per cell in ohms.
r_a'' = terminal resistance except batteries.

The cost of supply from a power plant depends upon the design of the plant, the efficiency of the units and the cost of primary power. Taking as a basis, 100 volts of supply and .050 ampere per wire, the annual cost of supply, including interest, depreciation, taxes, maintenance and the cost of primary power, has been estimated for six cases, as follows:

TABLE OF ANNUAL COST PER MORSE WIRE FOR A SUPPLY OF 100 VOLTS AND .050 AMPERE FROM A POWER PLANT.

Number of Morse Wires	A	B	C	D	E	F
1	$42.10	$60.20	.....	.....	.....	.....
2	23.60	34.40	.....	.....	.....	.....
3	17.50	25.80	$40.10	$76.70	.....	.....
4	14.40	21.50	.....	.....	.....	.....
5	12.60	19.00	.....	.....	$45.80	$62.00
6	.....	.....	23.40	41.40	.....	.....
9	.....	.....	17.70	29.60	.....	.....
10	.....	.....	.....	.....	24.00	31.80
12	.....	.....	14.90	23.70	.....	.....
15	.....	.....	13.30	20.20	.....	.....
20	.....	.....	.....	.....	13.20	16.80

Column *A* is calculated from the assumption of a 25-watt dynamotor furnished with direct current at $.10 per K.W.H.; *B* is based on a dynamotor of the same

*A report on the use of copper, iron, and copper-clad steel wires in telegraph service, made to Frank K. Chambers, Jr., vice-president of the Duplex Metals Company, August 1, 1910. Continued from the May number of TELEPHONE ENGINEER.

size, but different make and efficiency, at the same cost of power; *C* is based on a 75-watt dynamotor, of the same type, at the same cost of power; *D* is based on a 125-watt motor-generator set, using alternating current, at the same price per K.W.H.; *E* is based on a "3-D" storage battery of 20-ampere-hours capacity, with an independent charging plant; *F* is based on a 40-ampere-hour battery and charging plant.

It will require 108 gravity cells, of 1.08 volts and 3 ohms internal resistance each, to furnish .050 ampere and 100 volts. At $.50 per cell per annum, 108 cells would cost $54.00 total, and it is apparent by comparing this estimate with Fig. 51 that except in isolated localities a power plant will be more economical than a battery. Even when a battery is compared with a power plant on a basis of unequal current per wire, somewhat in favor of the battery, the power plant is still the most economical. Take a case of a battery of 600 cells, in 6 groups, each group supplying 3 wires, or a total of 18 wires; the total annual charges at $1.00 per cell will be $600, or $33.30 per wire per annum, which is over 65 per cent more than the estimate for any of the power plants.

Since the annual charge on copper and copper-clad wires of the same size are equal, or very nearly so, it follows that No. 9 copper-clad cannot be substituted for No. 9 copper at the limit of 293 miles, and less, if the cost of current supply is perceptibly increased.

The following comparisons have been made between No. 9 copper and smaller sizes of copper-clad, assuming 150 ohms resistance at each terminal exclusive of the batteries or the generators.

COMPARISON OF NO. 9 COPPER WITH NO. 10 COPPER-CLAD ON A BASIS OF BATTERY SUPPLY.

	Total Annual Charges.
263 miles of No. 9 B. & S. Copper	$1,070
78 cells of battery	39
Total	$1,109
263 miles of No. 10 B. & S. copper-clad	$ 947
204 cells of battery	102
Total	$1,049
Saving by use of copper-clad	$ 60

This shows a moderate saving in favor of No. 10 copper-clad over No. 9 copper, where battery supply is employed. The previous table shows that $20.00 per annum is a fair average charge for a generator or power plant supply of .050 ampere at 100 volts, or $.20 per volt per annum. The last basis of supply results in a different comparison, as follows:

COMPARISON OF NO. 9 COPPER WITH NO. 10 COPPER-CLAD ON A BASIS OF GENERATOR SUPPLY.

	Total Annual Charges.
263 miles of No. 9 B. & S. copper	$1,070
71 volts of supply	14
Total	$1,084
263 miles of No. 10 B. & S. copper-clad	$ 947
189 volts of supply	38
Total	$ 985
Saving by use of copper-clad	$ 99

Comparing all the sizes of copper-clad from No. 9 to No. 12 with No. 9 copper, both with battery supply and generator supply, the result will be as next given.

COMPARISON OF COPPER WITH COPPER-CLAD ON A BASIS OF BATTERY SUPPLY.

	TOTAL ANNUAL CHARGES. Copper.	Copper-Clad	Saving.
293 miles	$1,235	$1,284	$ 49
263 miles	1,109	1,049	60
237 miles	1,001	882	119
213 miles	900	756	144

COMPARISON OF COPPER WITH COPPER-CLAD ON A BASIS OF GENERATOR SUPPLY.

	TOTAL ANNUAL CHARGES. Copper.	Copper-Clad	Saving.
293 miles	$1,209	$1,227	$ 18
263 miles	1,084	985	99
237 miles	978	810	168
213 miles	897	676	203

These tables show that No. 10 copper-clad is cheaper than No. 9 copper on a basis either of battery supply or generator supply. The latter is usually available at offices in any town of considerable size and in all cities. The smaller sizes of copper-clad are correspondingly more economical.

It has been assumed that when batteries are used the line current will be maintained at .050 ampere. If instead it should be .040 ampere, a No. 12 copper-clad line 213 miles long would show a net saving annually of $165 over No. 9 copper.

If the cost of battery maintenance should be taken at a higher figure, say $.65 per cell per annum, No. 10 copper-clad would still be more economical than No. 9 copper and No. 12 would save $116 per annum, net, on a line 213 miles.

The possibility suggests itself of using No. 11 or No. 12 copper-clad in place of a long line of No. 9 copper, with repeaters at the center of the line. The presence of repeaters will increase the cost of operation somewhat on account of the necessity for repeater supervision to keep the apparatus in adjustment. An operator can ordinarily keep six simplex repeater sets in first-class adjustment. If he receives $90 per month, or $1,080 per annum, the cost of supervision will be $180 per annum. This is a maximum estimate and presupposes the highest quality of service.

No. 12 copper-clad will operate over a line substantially half as long as No. 9 copper, or half of 437 miles. At this line length a through circuit of No. 9 copper compares with a circuit of No. 12 copper-clad with repeaters at the center of the line, as follows:

SAVING OF NO. 12 COPPER-CLAD CIRCUIT WITH REPEATERS OVER THROUGH CIRCUIT OF NO. 9 COPPER.

	Total Annual Charges.
437 miles of No. 9 copper	$1,779
116 cells of battery	58
Total	$1,837
437 miles of No. 12 copper-clad	$1,289
524 cells of battery	262
Repeater supervision	180
Total	$1,731
Net saving of copper-clad	$ 106

The same comparison for No. 11 copper-clad shows a net saving of $30 annually, but the comparison is slightly unfair to copper-clad because the permissible circuit length is 37 miles greater than the No. 9 copper circuit. If generator supply is employed, a 437 mile circuit of No. 10 copper-clad will cost $16 net, per annum, more than a through circuit of No. 9 copper, but the latter has a permissible circuit length 89 miles less than the former; and hence for a 526 mile circuit, No. 10

copper-clad with center-line repeators and generator supply is more economical than copper.

The number of repeater stations in a long circuit has a preceptible effect on the speed of signalling, and it should be a minimum. But New York-San Francisco circuits are operated with about five repeater stations. In general 500 miles is the average maximum distance worked without repeaters.

The railroads in the United States send nearly twice as many telegrams, in the aggregate, as the telegraph companies handle in commercial business. The railroad stations comprise a very large proportion of the whole number of telegraph offices, and through them is handled a considerable volume of the commercial telegraph business, although not a large percentage of the whole. The railroad field therefore commands special consideration.

The general unit in railway organization is the division. Each division has a principal office or division headquarters, from whch the division is executively governed. The local offices on each division, except possibly some unimportant branch line offices, are usually in telegraphic communication with the division headquarters. This communication is had ordinarily over two local circuits, one being termed the "train wire," and the other the "message wire." A division is commonly about 150 miles in length on Eastern trunk lines, but in the West it is often 200 and sometimes 300 miles in length. On long or busy divisions the more important local offices are sometimes grouped on a special circuit, in order to relieve the congestion of the local circuits which otherwise would delay business.

The division offices are generally grouped on one or more through circuits reaching the general offices or administrative headquarters of the system. These circuits are often worked simplex, but in many cases they are duplexed or quadruplexed. There are few circuits of this character more than 1,000 miles in length and not many as long.

For the purpose of considering the possible saving from the use of copper-clad steel wire, a railroad system will be assumed to have 1,500 miles of main and branch lines, made up of 550 miles of main line in four divisions, 250 miles of alternate or parallel routes to the main line, and 700 miles of branch line. It will be assumed that there is one train wire and one message wire covering the whole of each division of No. 8 iron, or a total of 3,000 miles. It will be assumed that there are two through circuits on the main line, both of No. 9 copper, or a total of 1,100 miles, and 600 miles of No. 8 iron circuit connecting important division offices. The totals will then appear as follows, with the corresponding annual charges.

1,100 miles of No. 9 copper	$ 4,477
3,600 miles of No. 8 iron	12,744
4,700 miles, total	$17,221

If the division terminals or headquarters are situated in large towns or cities, making it possible to place repeaters in the through circuits, with current supply from generator sources, No. 12 copper-clad could be substituted throughout the system, with the following saving:

4,700 miles of copper and iron	$17,221
4,700 miles of No. 12 copper-clad	13,865
Gross saving	$ 3,356
Increased cost of current supply	150
Repeater supervision	360
Net saving per annum	$ 2,846

The corresponding total saving if No. 11 copper-clad were used would be $1,483 per annum. On most trunk line roads it is possible to employ repeater stations at or near the desired locality. It is now frequently done on through circuits of iron, or on long copper circuits, or where a branch is connected to a main line without looping it into the circuit. In some instances iron circuits are worked over distances of 300 or 400 miles without repeaters, except in bad weather.

These comparisons have been made on the impartial basis as nearly as possible, assuming first-class service in all cases. Briefly they show that copper-clad steel of No. 10 B. & S. gauge, or smaller, is more economical than No. 9 copper or No. 8 iron for local or through circuits less than 263 miles in length; and further, No. 10 copper-clad, with repeaters, can be substituted economically for a circuit of copper 525 miles long without repeaters, and similarly No. 11 copper-clad, with repeaters, can be substituted economically for a copper circuit 475 miles long without repeaters.

Representatives of Indiana Lines Test Signal System

Two members of the Indiana Railroad Commission and officials representing all of the leading electric railways operating in the state witnessed a successful demonstration of the Gill selective signal system recently on the Connersville division of the Indianapolis & Cincinnati Traction Company lines. Practically all of the traction men agreed that the system is a big step toward eliminating wrecks.

The party left the traction terminal station in a special car for the Rushville-Shelbyville junction, where the part of the system in the dispatcher's office there was examined. M. E. Launbranch, Chicago representative of the United States Electric Company, which manufactures the apparatus, explained to the members of the party the workings of the keyboard in the dispatcher's office. The keyboard is fitted with as many keys as there are semaphores. By throwing a certain key the semaphore at a given point will indicate that there is danger ahead. The contrivance worked perfectly.

At Rushville a semaphore had been installed temporarily near the power house of the I. & C. After the party arrived there, the dispatcher at the junction turned a certain key, operating the semaphore for several minutes, until the move had been thoroughly examined by members of the party.

The Gill selective signal system is purely a safety device. It makes possible the operation of every semaphore signal by the regular wires used by the train dispatcher. Under the system no one but the train dispatcher will have control of the trains, whereas, under the system in use on many interurban roads in Indiana, other persons assist in operating trains. Each time the dispatcher moves a key he received a definite audible answer, showing that that signal and no other has gone to the desired location.

Furthermore, the signal is so locked that it cannot be restored manually to "line clear" position without the consent of the dispatcher. It has been so arranged that it can be applied to existing telephone lines and on the same wires can be operated the Gill selective ringing system at such points where there are attendants. Under this system the annoyance of code ringing is entirely removed.

The members of the party were Judge W. J. Wood, and Judge J. F. McClure of the Railroad Com-

mission; H. A. Nicholl, and George H. Kelsey, Union Traction; C. F. Franklin, Winona Traction; Alexander Shane and L. M. Brown, I. C. and S.; C. E. Morgan, Ben Hur; A. J. Boardman, G. J. Jeffries and E. B. Peck, T. H., I. & E.; M. E. Graston, I. N. & T.; E. B. Lincoln, Muncie & Portland; H. D. Murdock, I. & L.; F. E. Cole, L. & N.; Charles L. Henry, George Henry, Oscar Lively, Leroy Cox, and Claude Gambern, I. & C.

Rock Island to Use Telephone

Telephones will be used in receiving and transmitting train orders on the Kansas division of the Rock Island railway after September 1. Dispatchers now handle the movement of trains on part of the Kansas division by telephones.

Instruments are installed and are used to handle movements of trains between Herington and Topeka, and Topeka to Horton. Workmen have commenced to string telephone wires from Belleville to Caldwell, a distance of 275 miles, and when this stretch is completed the entire Kansas division will be covered by telephone lines. It is thought that the telephone line from Belleville to Caldwell will be completed in three months.

Leading railways are substituting telephones for telegraph wires in the movement of trains. Train orders may be transmitted more quickly by telephone than by telegraph. Railway officials estimate that dispatchers will be able to save 50 per cent of their time by the use of the telephone. A dispatcher in order to call an operator or agent by telephone, presses a button, which rings a bell in the office which the dispatcher wishes to call. After getting the operator's ear, the dispatcher can talk to him, quickly communicate train orders to him, whereas if the messages are transmitted by telegraph tedious delays are apt to ensue.

The Rock Island railway will continue to use its telegraph lines for the transmission of ordinary messages and company business.

Two new telephone circuits have just been installed on the Cincinnati, New Orleans and Texas Pacific, between Danville, Ky., and Oakdale, Tenn., a distance of 134 miles. One of the circuits is to be used by the train dispatcher and the other for messages. The telephone is rapidly taking the place of the telegraph on the entire Queen and Crescent system.

Lehigh Valley Extends Its Telephone System

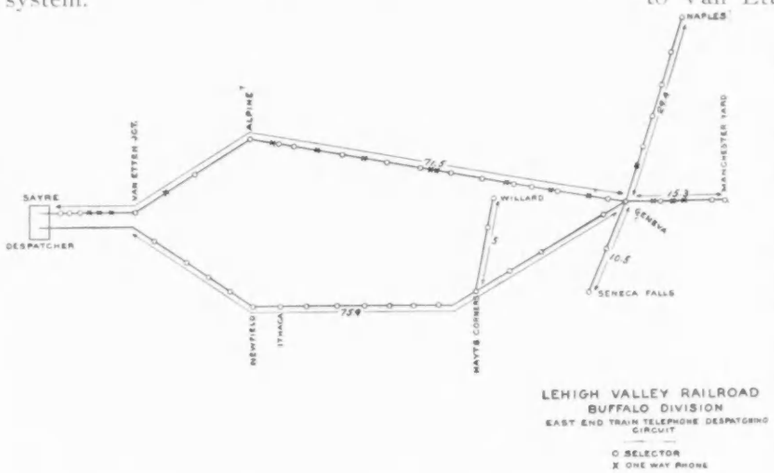
The Lehigh Valley railroad, which already has a large percentage of its system equipped with telephone dispatching apparatus, has just placed an order with the Western Electric Company for similar equipment for use on the east end of its Buffalo division. When this equipment is installed the Lehigh will have all its main line between New York and Buffalo equipped for telephone train dispatching except a short strip on the West Buffalo division of less than ninety miles, and it is expected that in the near future this section will be similarly equipped.

On the new circuit just ordered several new ideas will be carried out. The line itself, which is now under construction, will be of 210-pound copper wire and its arrangement will be different from any now in use. The wire will be located on the top crossarm, which will make it necessary to re-arrange the present telegraph circuits. Experience with the telephone circuits which have been in use for the past year on other sections of the road, however, indicates that the saving in maintenance will more than justify the additional expense of this arrangement.

The main line over which the dispatcher handles trains extends from Sayre, the dispatcher's office, to Manchester Yards, a distance of 86 miles. At Van Etten Junction, the Ithaca branch leaves the main line, meeting it again at Geneva. This branch, including a five-mile branch to Willard, is eighty miles in length. At Geneva there are two branches, one to Naples, 29 miles long, and one to Seneca Falls, ten miles long. This makes the total length of the circuit approximately 208 miles.

Forty-eight local battery, Western Electric selectors, will be used on this system. The sending key cabinet will be so arranged that when a dispatcher is calling stations on the main line, current will not be sent out on the Ithaca branch. This arrangement makes it possible to use but half the voltage necessary to operate the whole circuit, and this will effect a material saving in maintenance.

The copy operator at Sayre will be furnished with a master key, which will enable him to take care of the circuit in case the dispatcher is out for a moment. Should the circuit be very busy this master key will enable him to take care of the Ithaca branch, while the dispatcher can take care of the main line. Two pairs of copper wires will be strung from Sayre to Van Etten Junction to make this possible.



LEHIGH VALLEY RAILROAD
BUFFALO DIVISION
EAST END TRAIN TELEPHONE DESPATCHING CIRCUIT

○ SELECTOR
X ONE WAY PHONE

At Van Etten Junction a switch will be so arranged that if either pair of copper wires between that point and the dispatcher's office at Sayre get into trouble, the dispatcher can automatically switch either the main line or the Ithaca branch on to the remaining pair of good wires and still keep the line in service.

There will also be a dispatcher's equipment installed at Geneva, which will handle the two branches from Naples to Geneva and Geneva to Seneca Falls. This equipment is so arranged that by the insertion of a twin plug in the proper jacks, these branches may be connected to either the main line or the Ithaca branch. This arrangement will be used at night when the dispatcher at Sayre handles the whole system.

Railway Test Boards

Many railroads have installed and are adding from time to time telephone circuits along their rights-of-way, these being generally for message work, in addition to the train wires already in service. When a plurality of circuits of this type extend along a railroad, some means of testing the lines and locating trouble upon them is essential.

The No. 1 type test board manufactured by the Western Electric Company is in very general service for this purpose. This test board consists of a number of jacks, as shown, arranged in two parallel rows, with a grounding jack at the bottom. The lines are brought into these jacks, one wire being connected to each jack, and are carried through the board and out to the line again from the jacks on the other side.

The wiring diagram of this test board illustrates how this is done. On telephone train dispatching circuits, jacks 1 and 3 and 2 and 4 are generally used for the train wire, while jacks 9 and 11 and 10 and 12 are employed for the message circuit. It will be seen that there are a number of cords and plugs at the bottom of the board. It is also obvious from the wiring diagram that the selector and telephone sets are bridged across the train wire in one case through a key, and across the message wire in the other case through a key on the other side of the board. This apparatus is tapped off the inside contacts of the jacks so that when a plug is inserted in the jack, the selector and telephone apparatus is cut off and thrown across the cord circuits by means of the keys.

Test Box.

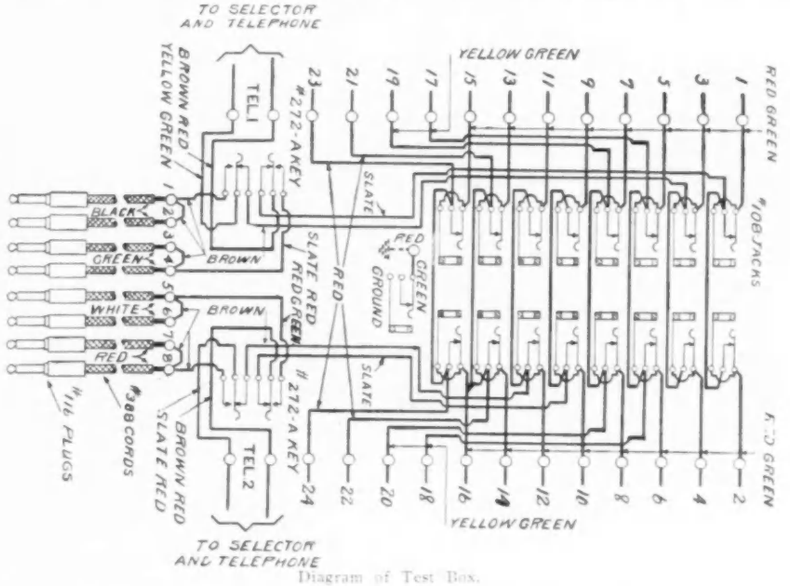


Diagram of Test Box.

As an illustration of the method of use of such a test board, it may be assumed that the train wire comes in on jacks 1 and 3 and leaves the office on jacks 2 and 4. The message wire comes in on jacks 9 and 11 and goes out on jacks 10 and 12. Trouble develops on the train wire between two stations. The dispatcher gets the next station before the break or the cross, whichever it may be, and orders the operator there to insert plugs 1 and 2 in jacks 1 and 10, respectively, and insert plugs 3 and 4 in jacks 3 and 12, respectively. He then orders this operator to throw the left-hand key to the "on" position, and, as will be observed, connects the selector and telephone set across the cord circuits, putting it thereby on the patched connection. He then gets the operator at the other side of the break either by telegraph or by the commercial telephone, and orders him to insert plugs 1 and 2 in jacks 9 and 2, respectively, and plugs 3 and 4 in jacks 11 and 4, respectively, throwing his left-hand key similarly to the other operator.

This makes a complete patch around the break, and puts the operator's telephone sets in on the patched connections. The message circuit, being of less importance, is used for making the patch, but if necessary a pair of telegraph wires or any wires available may be so used, provided they are constructed so that telephone conversation is possible over them.

Inserting one cord of a given color in a jack and the other cord of the same color in the ground jack, grounds that wire. A pair of wires may be short-circuited by inserting cords of the same color in the two jacks to which those wires are brought. A wire may be opened by inserting a plug in the jack, care being taken to see that the plug of corresponding color is not used elsewhere.

By means of this apparatus the greatest flexibility is given to the telephone lines in railway service, and it becomes possible to make all the simple tests ordinarily required on lines of this character.

C., B. & Q. Extends Telephone System

The Chicago, Burlington and Quincy railroad, which was one of the first to use telephones for train dispatching, has just placed an order with the Western Electric Company for twenty-seven of its new selectors and associated telephone equipment for use on its Saint Joseph division.

This new circuit will be installed between Kansas City and Napier, Missouri, a distance of 96 miles, and the dispatcher will be located at Saint Joseph. For use with the telephones on this division a supply of the new Western Electric moisture-proof cords has been ordered. Samples of these cords have been under test for some time on other divisions and the

results have been so satisfactory that all the telephones on this new division will be similarly equipped.

When this equipment is installed the C., B. & Q. will be operating over 2,700 miles of track by the telephone.

Appliance Association to Join Superintendents

In conjunction with the annual convention of the Association of Railway Telegraph Superintendents, to be held at Boston, June 19 to 23, the Railway Telegraph and Telephone Appliance Association will hold its annual meeting. The Appliance Association has increased its membership considerably since last year, and expects to hold an interesting convention. The exhibits of members will be a valuable feature of the convention of Telegraph Superintendents.

"Katy" to Equip 355 Miles With Telephones

Within a short time the Missouri, Kansas and Texas railroad will be using the telephone to dispatch trains on both its Fort Worth and its Dallas divisions. An order has just been placed with the Western Electric Company for 49 of its new selector and telephone equipments.

The Dallas division runs from Dennison to Hillsboro via Dallas, a distance of 172 miles, and has a branch line of 22 miles from Dallas to Lewisville. On this division, selector equipment for 29 stations will be used. The dispatcher will be located at Dennison. The main line circuit will be constructed of No. 9 B. & S. copper wire and on the branch line No. 8 BWG iron wire will be used.

The Fort Worth division extends from Dennison to Hillsboro, a distance of 152 miles, with a branch 9 miles long extending from Egan to Cleborne. It will be equipped with selectors and telephone apparatus for 20 stations. The dispatcher for this division will also be located at Dennison.

The M., K. & T. is also equipping its Waco division with 33 Gill selectors.

Chicago, Milwaukee and Puget Sound Will Equip

The Chicago, Milwaukee and Puget Sound will soon be using the telephone to dispatch its trains between Mobridge, South Dakota, and Deer Lodge, Montana, a distance of 755 miles. An order has just been placed with the Western Electric Company for seventy-five sets of its new selector and telephone equipments. Five sections will be equipped as follows:

Mobridge to Marmath, 190 miles, equipped with 18 stations.

Marmath to Miles City, 124 miles, equipped with 10 stations.

Miles City to Harlowton, 216 miles, equipped with 14 stations.

Harlowton to Three Forks, 111 miles, equipped with 11 stations.

Three Forks to Deer Lodge, 114 miles, equipped with 14 stations.

One dispatcher will be located at Mobridge and two at both Miles City and Three Forks.

Copper wire, running 210 pounds to the mile, will be used for these circuits.

Of Interest to the Trade

By A. L. Haase

Particular Precision Instruments

Illustrated here is one of the finest examples of exactitude in instruments that is ever given the ordinary man to see.

The Thompson-Levering switch dial sets, with the latest improvements in switch construction, are specially adaptable to all tests using Wheatstone Bridge conditions.

Rheostat has four dials of ten coils each. The dials have values of units, tens, hundreds and thousand ohm coils, all guaranteed to one-tenth of 1 per cent. The bridge arms have values of 1, 10, 100 and 1,000 ohms, in each arm, all guaranteed accurate to one-twentieth of 1 per cent. This is double the accuracy of the average set.

What should make particular appeal to the engineers and testers is the fact that the Peerless, as this popular set is named, takes an ordinary dry battery, such as can be obtained at any supply house, and no adjustments need be disturbed when replacing batteries.

Every one at some time or other has experienced the discomfort of trying to buy the special shaped battery ordinarily used by some manufacturers, so this new departure should find instant favor.

The quick acting, positive, wipe-contact on this switch dial set is also a commendable feature and those of us who have experienced the doubtful joys of juggling plugs to obtain variable resistances will appreciate this feature.

The instrument is probably the smallest yet produced and weighs but 7¾ lbs. as carried by the tester.

The case is of mahogany handsomely polished, all the metal work being of lacquered brass.

More information in detail can be obtained by writing direct to Thompson-Levering Co., 244 Arch St., Philadelphia, Pa.

Black-Finished Desk Stands Popular

As far back as 1908 the engineering department of the Western Electric Company began a series of experiments and tests to find a more serviceable finish than nickel for desk stands. The nickel finished stand was not proving entirely satisfactory owing to its tarnished and brassy appearance after a comparatively short period of service. In addition, the cost of refinishing was high.

Black Desk Stand.

These tests were carried on continuously for the next two years and during that period sample stands were made up finished in enamel, celluloid, agate, rubber paint, rubber japan and even in a composition used on shoe-eyelets. After these stands had been subjected to rigid tests to determine their value under all conditions of service, it was found that the rubber japan finish then being applied to the No. 20-S desk stand was the most satisfactory.

During 1909 the demand for this stand steadily increased as it was found not only to equal the nickel stand in life, but in addition, to present a better appearance while in service. Furthermore, there was a considerable saving in the cost of maintenance. In 1909 the sales of the black finished stand represented only 40 per cent of the total output; by the end of 1910 the demand had risen to 63 per cent, and during the first three months of 1911, 81 per cent of orders called for stands having the new black finish. The Western's total desk stand output exceeds half a million a year.

Chicago Automatic Offers Prizes for Subscribers

The Subway Telephone Construction Company, in the Chicago daily papers of May 1, carried a full page advertisement calling attention to its progress in gaining subscribers. The feature of the advertisement was an offer of $25,000 in prizes, as follows:

To the person securing the largest number of service contracts on or before July 1, 1911, first prize, one thousand dollars.

To the person securing the next largest number of service contracts on or before July 1, 1911, second prize, five hundred dollars.

To the four persons securing the four next largest number of service contracts on or before July 1, 1911, two hundred and fifty dollars, each.

To the six persons securing the next largest number of sition is open to and includes all business contracted in accordservice contracts on or before July 1, 1911, one hundred dollars, each.

To the twenty persons securing the next largest number of service contracts on or before July 1, 1911, fifty dollars, each.

To the thirty-six persons securing the next largest number of service contracts on or before July 1 ,1911, twenty-five dollars each.

To the one hundred persons securing the next largest number of service contracts on or before July 1, 1911, ten dollars, each.

In addition to the foregoing, and subject to the conditions hereof, we will pay fifty cents for each service contract, regardless of whether or not you are one of the prize winners. All contracts taken hereunder, in order to be counted, shall be signed by a responsible party and accepted by us. This propoance herewith and the printed instructions to be furnished on application at our offices up to and including July 1, 1911. Everybody is eligible to accept this offer except employes of the Subway Telephone Construction Company and the Illinois Tunnel Company.

It is stated that the plan is working out nicely to the advantage of the company, which expects to have installed well over the 20,000 required to hold its franchise in June.

Kellogg Salesmen Distributing "Smoker's Delight"

A Kellogg reminder in the shape of the well known paper match folder is being distributed and proves an attractive advertising card.

Each match is labelled with the name of an apparatus type, such as "Farm Telephones," "Magneto Switchboards," "Pole Changers," etc. On the reverse side of the folder is given the company name and the principal types of apparatus manufactured. On the end is the familiar "Kellogg" mark in red, while on the front is a well executed lithograph of the Kellogg desk stand with the company slogan, "The Service of the Telephone Proves the Worth of the Line." Small cases in variously colored leathers hold these match folders, making a very attractive advertising novelty. They have been given a wide distribution and may be obtained from the Kellogg salesmen, but on account of government regulations cannot be mailed.

Hubbard Underhang Brackets

The illustration is only one of a number of styles of underhang brackets made by the Hubbard Company, Pittsburg, Pa.

The company has had a big sale of this type of bracket on account of the saving effected by its use. For instance, a telephone company has a new subscriber along a pole line, and the present cross arms are full; it was formerly the custom to gain the pole and set in a new arm to accommodate the extra circuit. This usually costs from 50 to 70 cents per arm, and the entire telephone rental for a year is frequently eaten up in the construction necessary to string the extra circuit.

Hubbard Underhang Bracket.

With the Peirce bracket, which is all steel, thoroughly galvanized to prevent rusting or weather deterioration, the extra circuit can be run on the present cross arms at less than half the cost of setting new arms.

No boring of the cross arm is necessary and no special tools are needed beyond those ordinarily carried.

Should enough subscribers be obtained to fill a complete cross arm, the brackets can be taken down and used elsewhere.

The company has a line of brackets designed for nearly every possible condition of wiring, and a handsome catalog, showing list and net prices, is mailed to every one interested in how to save money on maintenance and still improve the service.

Charles L. Peirce is manager of the Peirce specialty department of Hubbard & Company, and his experience and knowledge of how hundreds of telephone companies meet special wiring conditions is at the command of those interested in this line of work—a sort of clearing house of ideas, as it were.

Book Review

Motion Study by Frank B. Gilbreth is an interesting book outlining a method for increasing the efficiency of workmen. Taking the workman as his subject of study, the author goes into all the "variables," mental, moral and physical, which have a bearing upon the workman's efficiency. The author approaches the subject in a scientific manner and offers many hints of wide-reaching significance.

As the title implies, the book is mainly concerned with a study of the workman's motions—the various bodily movements entailed by the performance of his daily task. The author states that there is no waste of any kind in the world that equals the waste from needless, ill-directed, and ineffective motions. He even goes so far as to say that among the thirty million workers in this country fully half their motions are wasted. The author argues that it is our duty to utilize some of this enormous waste if we can, and his book outlines the means of going about it.

Of course, there is nothing new about "motion study." Every industry has practiced it, but generally in a haphazard way. Mr. Gilbreth shows how the subject may be approached in a systematic manner. He believes he has the basic principles of an important science—one that should be fostered by the government, as a conservation measure.

Whether Mr. Gilbreth's contentions are sound only the test of experience can say. His theories are certainly fascinating enough to induce one to put them in practice. For all employers of labor the book contains many stimulating suggestions.

Published by D. Van Nostrand Company. Bound in cloth. Price $2.00.

Kerite Opens Western Office

The Kerite Insulated Wire and Cable Company, with general offices in the Hudson Terminal Building, New York, announces that having acquired the interests of its western representative, the Watson Insulated Wire Company, it has opened a western office in the Peoples Gas building, Chicago. B. L. Winchell, Jr., formerly vice-president of the Watson Insulated Wire Company, has been appointed western sales manager.

Page and Hill Install Preserving Plant

The Page & Hill Company has just installed at its Minnesota transfer yard a plant for giving cedar poles a preservative treatment.

Wood preserving has now gone beyond the experimental stage, and it has been demonstrated beyond a doubt that a proper and thorough treatment will double or treble the life of a pole, thereby effecting a wonderful saving in the per annum cost of pole line maintenance.

Progressive engineers, realizing this fact, have begun to demand treated poles, and it is to meet this demand that the company has established this plant.

Western Electric Telephones Popular With Farmers

The Western Electric Company continues to report large sales of its No. 1,317 type rural line telephones. Its shipments are now running at the rate of fifteen carloads a month.

The accompanying cut shows a group of Texas farmers, each equipped with a No. 1,317 type telephone, which they are about to install on a rural line that will give them connection with the Abilene exchange.

The rural telephone is a great boon to the farmers, especially to those in the south and west, where distances are so great.

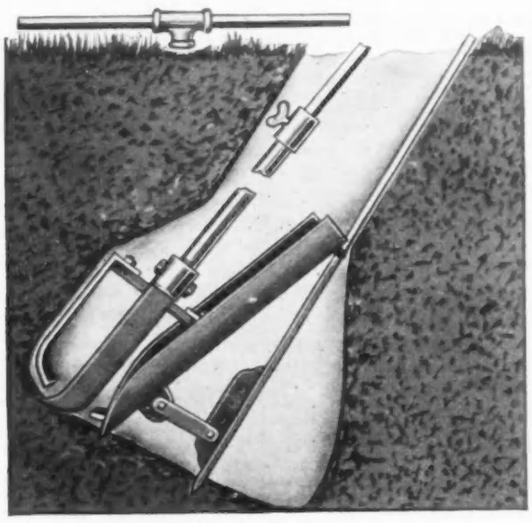
Twenty Farmers with Magneto Telephones Ready to be Installed.

An Old Standby

Yoicks and tally ho!
Ta ra ta ra ta ra!

or whatever else is customary. The elephants are coming and here is Miller's famous anchor.

The picture shows a Miller anchor as it appears from a worm's-eye profile view. The dead man fea-



Miller Deflector Enlarging Hole for Anchor.

ture is brought to life and improved on. The anchor when set pulls against solid earth, and it is claimed by the company that this anchor will never creep. One can easily believe this is true when you realize that the Miller anchor has been used by railroad companies to give purchase to wrecking tackle when re-

Miller Anchor Installed.

moving engines or cars. A strain of that nature is greater than any that a loaded telephone pole can impose; in fact, the solid bessemer steel rod will break before the anchor will pull up, and those in the know usually bank on the kind of rods Miller furnishes.

Considering the low price of these anchors one is not surprised to hear of their adoption by the largest as well as the smallest telephone companies in this country.

To set the Miller anchor a tool known as the "deflector" is used, which bores the hole larger at the bottom than at the top—the illustration shows the idea better than words can tell it. No company need be afraid of adding this tool to its equipment, as it is a rapid borer and can be used for different purposes.

It is unethical for a publisher to let his experiences creep into the manufacturer's section, but we've set some Miller anchors in our time with good success.

More information and of a technical kind can be obtained by addressing the Miller Anchor Co., of Norwalk, Ohio.

Frankel Testing Clips

Illustrated here is a new testing clip manufactured by the Frankel Display Fixture Company, Hudson and Vestry streets, New York.

The success of the company's regular clips has created a demand for a bigger brother of these popular devices.

The new clip is made of German silver with powerful spring jaws, in the upper one of which is firmly riveted a hardened steel point which, when the clip is clamped over the wire, penetrates any insulation.

New Frankel Clip.

The German silver makes a better conductor and the clip has been ordered in large quantities by every one that has seen a sample. The number of the new clip as shown by the company's literature will be Number 2538.

Handling Emergency Switchboard Orders

The fire which wiped out the business portion of the city of Bangor, Maine, on the evening of Sunday, April 30, also destroyed the telephone exchange. All records were broken in getting a new exchange equipment to the spot. In fact, while the flames were still raging in Bangor, part of the replacing equipment had already begun to leave the Western Electric Company's factory in New York City.

There have lately been a number of similar emergency cases, which have called attention to the facilities the Western Electric Company has for restoring telephone service with a minimum of delay. Fires are bound to occur in telephone exchanges at various points, and the manufacturers have found it advisable to be always prepared for instant action night or day in case of any emergency of this sort.

One of the most necessary instruments in the work of reconstruction following a disastrous fire is the telephone, and until some sort of service is restored work of every sort is bound to be hampered, if not made entirely impossible. Let any business man try to do without his telephone for one day if he doubts the truth of this assertion.

It is in view of just such facts as these that in the shipping rooms of the manufacturers equipment

already boxed, and with blank shipping orders close at hand, is ready to leave on almost an instant's notice.

The arrangements that have been made for the filling of emergency orders have been prepared with every attention to detail. It is possible to furnish from any one of the various points at which emergency stock is kept either the entire equipment or any portion of it without unpacking.

Arrangements are made with the telephone and telegraph companies, so that an emergency call coming in at any time outside of office hours is immediately sent out to the chief operator of the private branch exchange at the Hawthorne plant. There is always some one on duty at this exchange. The night operator has in his possession a list of names, with telephone numbers, of several individuals in the organization, one of whom must be notified in case of an emergency.

The operator has instructions to locate positively some one individual whose name apears on the list and give to him the information which has been telephoned or telegraphed in. It is then up to the individual thus notified to secure whatever assistance is needed to get out the necessary equipment at the earliest possible moment. As in the case of the Bangor fire, a force can be secured in the middle of the night, express companies notified and arrangements made for shipping material on the next train by express absolutely without delay.

When the fire at Bangor was at its height it was seen that the telephone exchange could not be saved. As a matter of fact the building in which the switchboards operated by the New England Telephone & Telegraph Company were located was absolutely wiped out by the flames, but it was before this that a message reached the Western Electric headquarters in Boston. From Boston word was dispatched by long distance telephone to the executive offices at New York, at which point emergency equipment also was located. The fact that it was Sunday evening added to the difficulties. However, a working force was speedily assembled, a number of trucks were gathered to the spot and this force worked all night.

The fire was not considered under control until Monday morning. By 11:30 Sunday night the first truck load had left for the Grand Central depot, and the rest of the equipment was being assembled to catch the first train for Bangor via Albany. The switchboard sent to Bangor was of the common battery, lamp signal type, consisting of seven sections, and with a capacity of 3,000 subscribers' lines. Occupying two cars on the Monday morning passenger express, it weighed 50,000 pounds. This board is considered adequate to take care of the telephone needs of the stricken city until a new exchange can be planned and built.

There have been other instances of a similar nature within the past few months. Not long ago a fire occurred in the office of the Spiceland Co-Operative Telephone Company, Spiceland, Indiana. In this case a shipment was made from the Western Electric Company's factory at Hawthorne and temporary service inaugurated the day following the disaster. The Spiceland company is a small one, and the emergency equipment was correspondingly small, but there is no doubt that the immediate restoration of telephone service was considered just as important by the subscribers as if they had been dependent upon the service from a big multiple switchboard.

When the exchange at Follansbee, West Virginia, was burned the order for a new equipment reached the Western Electric Company at Pittsburg one hour later. An emergency equipment started on its way to Follansbee at 11 o'clock the evening of the fire, and by 1 o'clock the next afternoon it had been installed in a temporary exchange across the street from the damaged building.

Of course, the most notable exploit of this sort was the shipping of a 10,000 line switchboard to Paris in the fall of 1908, when the Gutenberg exchange in that city was completely wrecked. The Western Electric Company had agreed to forfeit $600 a day for every day's delay, but the 4,500-mile journey was completed and the big exchange equipment was running full speed, with a staff of ninety operators, before the sixty days agreed upon as a time limit had expired.

Brevities of the Business

PERSONAL NOTES.

Henry M. Watson, a pioneer telephone capitalist and until recently president of the Bell Telephone Company of Buffalo, died Friday, April 21st, at a sanitarium at Watkins, N. Y. Mr. Watson became associated and interested with Edward J. Hall in the telephone as early as November, 1878, and has been president of the Buffalo company continuously since that time. He had within a few weeks of his death registered his name on the roster of the Telephone Pioneers of America and is therefore the first person to be recorded on its death roll. Mr. Watson was born in Unadilla, N. Y., on May 13, 1839, was well known in railroad circles through connection with steam and street railways, and also in telephone circles by reason of his long and continuous service as president of the Buffalo company. He was a man of great activity and keen business insight, but withal had a genial nature and friendly loyalty that gained him hosts of friends.

John J. Nate, so widely known in telephone circles, died at the home of his daughter in Winona, Minn., April 30, 1911. Mr. Nate was a native of Illinois, having been born at Rochelle July 22, 1857. He entered the employ of the Chicago Telephone Company as lineman in 1878 and soon rose to the position of purchasing agent, in which position he served the company during the period of its greatest extension and development. He resigned his position with the company about 1895 and became interested in the independent telephone manufacturing field, as a stockholder and officer of the Metropolitan Electric Company of Chicago. Later he was connected with the Standard Telephone and Electric Company, Madison, Wis. At the time of his death he was manager of the Northwestern branch of the Stromberg-Carlson Telephone Manufacturing Company, Rochester, N. Y., with headquarters at Minneapolis, which position he has filled for the past nine years.

W. A. Sherin, of Neena, has been appointed manager of the Wisconsin Telephone Company's New London exchange, succeeding G. R. Lyman.

Arthur Chafee, wire chief for the Central Union Telephone Company at Shelbyville, Ind., has been promoted to the position of general supervisor of all toll lines between that city and Madison and between that city and Hamilton, Ohio.

E. S. Woehr, manager of the Central Union Telephone office at Kewanee, Ill., has resigned his position to engage in the insurance and real estate business.

Theodore N. Vail, president of the American Telephone and Telegraph Company, has been elected a director of the New York, New Haven & Hartford Railroad Company, suceeding the late Nathaniel Thayer, of Boston.

Bernard W. Trafford, Detroit, Mich., formerly vice-president of the Michigan State Telephone Company, has been elected second vice-president of the Chicago Telephone Company, in charge of the commercial department.

Fred A. Dolph, receiver for the Interstate Independent Telephone Company, has been elected president of the Independent Toll Clearing House Company, recently organized.

George E. Corke has been appointed manager of the Chicago Telephone Company's exchange at Morris, Ill., succeeding J. A. Poole.

R. Andrews, of Springfield, has been appointed local manager of the Central Union Telephone Company at Lewiston, Ill.

Charles S. Gleed, of Topeka, Kans., president of the Missouri and Kansas Telephone Company, and the Bell Company of Missouri, has been elected president of the Pioneer Telephone Company of Oklahoma, placing the three companies under one head.

John J. Speed has resigned his position as manager of the Valley Home Telephone Company, Saginaw, Mich., and will hereafter be identified with the Eectrical Products Company, which he has organized for the purpose of manufacturing the "Speed-O-Phone," an interior telephone designed by Mr. Speed, and on which he is seeking a patent. The company is located at 1914-15 North Michigan avenue, Saginaw.

H. M. Kerns has been appointed manager of the Rocky Mountain Bell Telephone Company at Miles City, Mont.

E. L. Hart, general manager of the Hanamo Telephone Company, has become general agent of the Home Telephone Company of St. Joseph, Mo., with headquarters at 306 North Tenth street, that city.

Eugene Nims, formerly president of the Pioneer Telephone Company, has been appointed vice-president of the Missouri and Kansas Telephone Company, the Bell Telephone Company of Missouri and the Pioneer Telephone Company and has moved his headquarters from Oklahoma City to Kansas City, where he will have offices with Charles S. Gleed, president of these companies. The transfer of Mr. Nims comes in the way of a promotion and is a deserved recognition of his success in building up the Pioneer Company.

E. W. Sewell has been appointed local manager of the Northwestern Telephone Company at Fargo, N. D.

P. R. Ridgely, with the Bell Telephone company, St. Louis, has been promoted by General Manager F. R. Mott, acting commercial superintendent of the company. Mr. Ridgely has been connected with the company since 1901 and for two years has been sublicense agent, in charge of all the company's business with other telephone companies in the St. Louis district.

Francis W. Dunbar, patent expert, so well known in the telephone field, leaves for a four months' vacation about June 1.

Horace F. Hill, Indianapolis, Ind., has been elected general manager of the Chicago Telephone Company, succeeding Angus S. Hibbard, who takes a position with the American Telephone and Telegraph Company, with headquarters at New York.

A. A. Gray, general manager of the *Electrical Review and Western Electrician*, has been chosen vice-president of the Electric Club of Chicago, to succeed C. A. Howe, resigned.

Richard Spencer, formerly manager of the Western Electric Company's Los Angeles house, but more recently in charge of their Buffalo house, died at his home in Danville, N. Y., May 6, 1911.

Peter J. Lynch, district superintendent of the Pacific Telephone and Telegraph Company in the Puget Sound territory, died at Seattle, May 1. Mr. Lynch had held various official positions with the company in California, where he was well liked, during a period of twenty years. For one year he acted as manager of the Philippine Telephone and Telegraph Company with headquarters at Manila.

Cyrus Osborne Baker, platinum refiner and importer, with wife recently sailed for England, where they will attend the coronation after which they will spend some time on the continent, returning to the United States about September.

H. A. Halligan, vice-president of the Western Electric Company, recently addressed the Telephone Society of New York on the theme, "A Brief Account of the Oldest Electrical Company in the United States," the occasion being the 128th meeting of the society.

The many friends of Daniel C. Gidley, and they are present in every town in the United States, will be pleased to learn that the Crouse-Hinds Company, as a reward for his long services on the road, has appointed him district manager for the New England territory, with headquarters at 201 Devonshire street, Boston. Mr. Gidley's perfect knowledge of Crouse-Hinds products, his ability as a salesman and pleasing personality should win him a full measure of success in his advanced position. It is reported in Sons of Jove circles that "Dan" Gridley, now that his traveling days are over, will soon become a benedict.

J. H. Longstreet has been appointed manager of the American Union Telephone Company's exchanges at New Castle and Elwood City, Pa. Mr. Longstreet was formerly connected with the Petroleum Company of Oil City.

Harley Stocking, Horton, Kans., has been appointed manager of the Northeast Kansas Telephone Company's exchange at Wathena. He will be succeeded at Horton by H. M. Pierson.

J. W. Reed has been appointed manager of the Napoleon Home Telephone Company at Liberty Center, Ohio.

Howard S. Hayes, district manager of the New York Telephone Company, Albion, has been transferred to the company's plant department with headquarters at Buffalo.

E. D. Selmser, for a number of years connected with the Winnsboro Telephone Company, Winnsboro, La., has taken a position with the Tel-Electric Company, Houston, Texas.

W. R. Hoy, who has served the New York Telephone Company as manager of its exchange at Lydonvile, has been appointed district manager with headquarters at Albion.

V. H. Drake has been appointed district plant engineer of the Central District and Printing Telegraph Company with headquarters at Greensburg, Pa.

Angus S. Hibbard, former manager of the Chicago Telephone Company, and author of the songs of the Chicago Association of Commerce, who goes to New York to associate himself with the American Telephone and Telegraph Company, recently received a gold baton from the association as a parting gift. Mr. Hibbard was also tendered a dinner at the La Salle Hotel, May 6th, by the employes of the telephone company.

CONVENTIONS.

The American Institute of Electrical Engineers will hold its annual convention in Chicago June 26 to 30 inclusive, in the new Hotel Sherman. Aside from the excellent program which will be provided, there will be visits to points of interest as well as various social events.

The Association of Railway Telegraph Superintendents will hold its annual convention in Boston June 26 to 30, having been postponed from an earlier date to meet the convenience of a great number of the delegates. The association anticipates one of the best conventions it has ever held.

MISCELLANEOUS.

GILLETT, ARK.—The Gillett telephone system has been purchased by the DeWitt Telephone Company of DeWitt. H. Rogers is manager of the company.

SAFFORD, ARIZ.—The exchanges of the Consolidated Telephone and Telegraph Company at Safford and Thatcher will be combined at Safford and a new exchange building erected at that place. It is planned to make Safford the central point of the Gila Valley system. Connection with the long distance toll line which reaches all telephone points in Arizona, California, New Mexico and western Texas will be established.

FREEPORT, ILL.—At the annual meeting of the Stephenson County Telephone Company reports showed the company to be in good condition. There was an increase of 300 subscribers during the year. The following officers were elected: President, Dr. C. L. Mease; vice-president, W. A. Hance; treasurer, E. T. Morse; secretary-manager, L. A. Herrick; directors, Chas. D. Knowlton, T. K. Best, Douglas Pattison, Wm. O. Wright and F. A. Read.

PEORIA, ILL.—There was recently held in this city a meeting of independent telephone managers and officials for the purpose of promoting an extension of telephone lines in this section. As outlined in that meeting it is the policy to extend copper lines in every direction within fifty miles of this city. Among the companies represented were the following: Citizens' Telephone Company, Pekin; Galesburg Telephone Company, Galesburg; Western Illinois Telephone Company, McComb; Henry Telephone Company; People's Telephone Company, Chillicothe; Washburn Telephone Company, Washburn; Roanoke Telephone Company, Roanake; Washington City and Rural Telephone Company; Eureka Telephone Company; Tazewell Tele-

phone Company; Tremont Telephone Company; Forrest City Telephone Company; F. C. Telephone Company, San Jose, and Interstate Independent Telephone Company, Aurora.

Tuscola, Ill.—S. C. Hankins has secured a controlling interest in the Tuscola Telephone Company, and has been elected president. C. W. Porter is secretary-treasurer, also acting manager.

Canton, Ill.—The Canton Home Telephone Company is planning extensive improvements in its system during the summer. The plans as outlined include the erection of a new exchange building and the extension and improvement of the lines in the city.

Springfield, Ill.—The Telephone Toll Clearing House Company, organized a short time ago, has elected the following officers: President, Fred A. Dolph, Aurora, receiver for the Inter-State Independent Telegraph and Telephone Company; vice-president, Dr. Collins, Decatur; secretary, M. B. Farwell, Bloomington; treasurer, Charles H. Archelphol, Quincy. Fifteen directors were also elected.

Clinton, Ill.—The officers of the National Telephone Company for the ensuing year are as follows: President, B. F. Wasson; secretary, J. R. Wasson; general manager, C. H. Coffman; wire chief, E. C. Wasson. The plans of the company contemplate a complete overhauling of the system, provided the franchise asked for is granted.

Oakland, Ill.—William Grimm has acquired the Oakland and Isabel telephone system with headquarters at Oakley, the consideration being $12,000.

Chicago, Ill.—Through an order signed by Judge Kohlsaat in the United States Circuit Court authorizing the receivers of the Interstate Independent Telegraph and Telephone Company to enter into traffic agreement with the Chicago Telephone Company, the Interstate company has at last gained its entrance into the city.

Chicago, Ill.—Through changes being made Chicago is to become the operating headquarters of the Bell business for Illinois, Indiana, Ohio, Michigan and Wisconsin.

Indianapolis, Ind.—At the annual meeting of the Indiana Independent Telephone Association the following officers were elected for the ensuing year: President, Nelson G. Hunter, Wabash; secretary-treasurer, Walter J. Uhl, Logansport. Executive Committee, Hart Farwell, Terre Haute; J. A. Browne, Winchester; Frank Rohn, Fort Wayne; A. J. Payton, Rockport; William Fortune, Indianapolis. All were re-elected, having served last year, except Mr. Farwell, who succeeds Mr. Thorward. A radical change was mode in the by-laws making it possible for independent companies which have connected with Bell toll lines to become members of the association.

Bloomfield, Ind.—The New Home Telephone Company, whose system covers Greene county and with principal office at Linton, will construct a new exchange building in this place.

Des Moines, Ia.—In accordance with the new Clarkson law, after July 4th telephones will have to be installed in coal mines.

Mason City, Ia.—The Western Electric Telephone Company of Mason City is planning extensive improvements in its system in this place, which will include larger and better equipment.

Oskaloosa, Ia.—The Oskaloosa Home Telephone Company has elected the following officers for the coming year: President, H. H. Evans, Aurora, Ill.; vice-president, H. H. Sheriff, Oskaloosa; secretary-treasurer, Dr. J. S. Appleman.

Hiawatha, Kans.—The city council has ordered all electric light and telephone wires in the paved district placed under ground.

Rising Sun, Md.—At the annual meeting of the Cecil Farmers' Telephone Company reports showed the net earnings for the year to have been in excess of 10 per cent. The following officers were elected: President, R. K. Rawlins, Woodlawn; vice-president, Elwood Balderston, Colora; secretary, Cecil E. Wing, Rising Sun; treasurer, J. T. C. Hopkins, Jr., Port Deposit.

Diller, Neb.—The Siller Telephone Company has elected the following officers: President, E. L. Loockl; vice-president, Clark Wells; secretary, A. L. Tintsman; treasurer, O. B. Hill. A dividend of 8 per cent was declared.

Broken Bow, Neb.—F. M. Currie, for many years head of the telephone system at this place, has disposed of his interests to the Nebraska Telephone Company. Claude Currie, son of F. M. Currie, will be retained as manager.

Bristol, N. H.—The Bristol Telephone Company, which covers Bristol, New Hampton, Bridgewater, Alexandria and Hebron, has been purchased by the Winnipesaukee Telephone Company, a branch of the New England company.

Newark, N. J.—The assets of the Telephone, Telegraph and Cable Company of America, bankrupt, were recently bid in by Henry S. Kearney, 100 Broadway, Manhattan, a heavy stockholder, at $75,000.

New York, N. Y.—Judge Watson has appointed Jesse Watson of this city, ancillary receiver in Illinois of the affairs of the Radio Telephone Company, which is in the New York bankruptcy courts. The Radio Telephone Company, a combination of the De Forest Radio Telephone Company, capitalized at $2,000,000 and of the Great Lakes Radio Telephone Company, an Arizona corporation, was organized to install wireless telephones and sparkless wireless telegraph systems. It has offices at Toledo, Cleveland, Milwaukee, Chicago, Detroit and Michigan City.

Coeymans, N. Y.—The stock of the Rural Telephone Company has been purchased by J. Harris Loucks, who will operate it in connection with the Clarksville Telephone Company.

New England, N. D.—The North Dakota Independent Telephone Company will install an exchange here.

Jamestown, N. D.—The Northwestern Telephone Exchange Company will spend $15,000 on rebuilding its exchange.

Belfield, N. D.—The Belfield Northwestern Telephone Company recently bought the stock of the Gartlin Valley Telephone Company, and will make extensive additions during the summer.

Sentinel Butte, N. D.—The Golden Valley Telephone Company at its annual meeting elected the following directors: A. L. Martin, H. L. Wheeldon, J. P. Smith, E. E. Mikkelson and C. E. Barber. After deducting depreciation the company has earned a little better than 5 per cent on a paid up capital of $10,500.

Springfield, O.—Announcement has been made of the purchase of the Springfield and New Carlisle Telephone Company by the Springfield and Xenia Telephone Company. Under the new plan the independent company will handle all of the local business, while the Bell concern will handle the long distance business.

Canal Winchester, O.—The Farmers' Independent Telephone Company has been purchased by the Central Union Telephone Company, and the stockholders have all been paid in cash the money they paid in the construction of the system.

La Grande, Oreg.—A deal has been completed whereby all exchanges and local equipment owned by the Pacific States Telephone and Telegraph Company in Union and Wallowa counties will be transferred to the Home Independent Telephone Company, a corporation financed and owned by Union and Wallowa county people. The transaction involves more than $200,000 and will give the Home company a total of 2,300 subscribers. The sale includes the exchanges at LaGrande, Union, Cove, Elgin, Wallowa town, Enterprise and Joseph.

Townville, S. C.—The Townville Telephone Company has elected the following officers; President and treasurer, E. C. Asbell; vice-president, John N. Bleckley; directors, E. C. Asbell, W. C. King, C. H. Burkley, W. F. McLees, J. F. Price, J. P. Ledbetter.

Hartford, S. D.—The Union Telephone Company and the Hartford Electric Light Company have been consolidated and in future will be under one management. C. J. Davis is manager of the company.

Sacul, Tex.—The Sacul Telephone Exchange has been purchased by J. W. Pye.

Corpus Christi, Tex.—The Southwestern Telegraph and Telephone Company will erect a fireproof central office building and will place its wires underground in the business section. When completed the central will have a capacity of 3,000 lines.

Sweetwater, Tex.—The Southwestern Telephone Company has taken over the telephone exchanges at Merkel, Trent, Colorado City, Roscoe and Cuthbery, operated by the Texas and Pacific Telephone system. The deal is said to have involved $100,000.

La Crosse, Wis.—The La Crosse Telephone Company has purchased a site at the southeast corner of Fifth and Jay streets on which it will erect a modern telephone building at a cost of approximately $15,000.

Wausau, Wis.—The Wausau Telephone Company has let contract for the erection of a reinforced concrete building, the same to be completed by January 1, 1912.

Racine, Wis.—The Citizens' Telephone Company has been purchased by the Wisconsin Telephone Company.

Janesville, Wis.—The Badger Telegraph and Telephone Company has amended its articles of incorporation changing its headquarters from Milwaukee to Janesville.